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FINAL EXPANDED SITE INSPECTION REPORT FOR FORMER SKEET AND TRAP RANGE NUMBER 1 MCAS CHERRY POINT NC

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CH2M HILL

Final

Expanded Site Inspection Report for Former Skeet and Trap Range #1

Marine Corps Air Station Cherry Point
Cherry Point, North Carolina

Contract Task Order 0026

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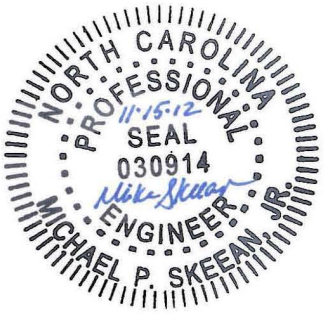

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Executive Summary

This document presents the data, results, and conclusions from the Expanded Site Inspection (ESI) conducted at the Former Skeet and Trap Range #1 (referred to hereafter as the Skeet Range) located at Marine Corps Air Station (MCAS) Cherry Point in Cherry Point, North Carolina. This ESI was performed to evaluate whether a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)-regulated release has occurred at the Skeet Range that warrants further action. Polycyclic aromatic hydrocarbons (PAHs) were identified in site sediment during the May 2009 Site Inspection (SI); therefore, additional sediment data was gathered in the February 2012 ESI to further evaluate the presence and potential source of PAHs at the site.

The Skeet Range was used for skeet and trap shooting from 1943 through approximately 1955. Skeet and trap shooting are shotgun target shooting sports where participants attempt to hit clay target disks that have been launched into the air at a variety of angles. Shotgun ammunition is not generally considered military munitions. The Skeet Range is approximately 16 acres in size and located along the northern boundary of MCAS Cherry Point, which was oriented in a north-facing direction with the skeet and trap shotfall zones located within the Neuse River. Concrete debris, possibly associated with the former range structures, is present along the sandy beach area bordering the Neuse River. However, site features that were located on the shoreline during Skeet Range operations are now located within the Neuse River. In the vicinity of the Skeet Range, the Neuse River is classified as Class SB Tidal Salt Water with primary recreation uses, aquatic life propagation and survival, fishing, and wildlife.

An SI was conducted in May 2009 to evaluate the presence of munitions constituents (MC) and to characterize potential impacts to surface soil, surface water, and sediment related to historical activities at the Skeet Range. The field activities included the collection of surface soil samples near the Skeet Range firing line for the analysis of metals, PAHs, and perchlorate, and the collection of surface water and sediment samples (to a depth of 6 feet below sediment surface) for analysis of metals and PAHs.

A Human Health Risk Screening (HHRS) and Ecological Risk Screening (ERS) were conducted for surface soil, sediment, and surface water to identify unacceptable potential risks to human health and ecological receptors. No unacceptable risks were identified in surface soils or surface water. However, the HHRS identified unacceptable potential risks to human health resulting from exposure to PAHs in sediment. No unacceptable potential risks were identified for ecological receptors. As a result, the SI recommended that an ESI be conducted to further evaluate PAHs in sediment and that a Watershed Contaminated Source Document (WCSD) be completed to evaluate potential sources of PAHs in sediment.

ESI field activities included the collection of 11 sediment samples within the Neuse River and Slocum Creek. Sediment samples were collected in close proximity to the former shotfall zone and upstream of the shotfall zone in the Neuse River and Slocum Creek at a sediment depth interval of 0 to 1 foot. All samples were analyzed for PAHs. In addition, a WCSD was completed to identify other potential sources of PAH contamination that are not associated with the site but lie within the Neuse River watershed in the vicinity of MCAS Cherry Point.

Analytical sediment data collected during the 2012 ESI were compared with data from the 12 sediment sample locations from the 2009 SI that were collected at the same depth interval. Several of the 2012 sample locations were located immediately adjacent to 2009 sample locations. Ten PAHs were observed above ecological screening criteria, and 5 PAHs were observed above human health screening criteria in the combined 2009/2012 sediment data. Although PAHs were observed above screening criteria in sediment within the site boundary, these PAHs are not likely associated with range activities due to the following:

- Lead shot and clay target fragments were not observed in site surface and subsurface sediment (to a depth of 6 feet below sediment surface). If site sediments were impacted by Skeet Range activities, it's anticipated that evidence of lead shot and/or clay target fragments would be present in site sediment. Additionally lead is the primary contaminant typically observed at skeet range sites, and lead concentrations were at or below background concentrations at the Skeet Range.

- The Skeet Range was operational from the 1940s to the mid-1950s. The Neuse River is a high energy environment, primarily due to wave action, and the shoreline in the vicinity of the site is erosional rather than depositional. As a result, PAH-containing materials, such as clay targets and clay target fragments, originating 6 decades ago are more likely to have been transported away from the Skeet Range than deposited in site sediments.
- A WCSD was prepared to evaluate potential non-site-related sources of PAHs impacting sediment at the Skeet Range and is presented in Appendix A. Numerous non-site-related potential PAH sources were identified within the watershed study area. Additionally, it is well documented that PAHs are ubiquitous in urban environments and are contributed to watersheds via stormwater runoff and atmospheric deposition from a myriad of sources, including the combustion of fossil fuels (e.g., exhaust from automobiles and airplanes and from power plant emissions), abraded tire particles and debris on roadways, asphalt pavement constituents, coal-tar and asphalt-based sealcoats, roofing tar, and used motor oil (ATSDR, 1995; Yang et al., 2010).
- PAHs were also observed in samples upstream of the Skeet Range, including one sample location at concentrations above screening criteria. Numerous non-site-related potential PAH sources were identified within the Neuse River watershed upstream of the site that may have resulted in the PAH concentrations detected within the former Skeet Range.
- Sediment samples collected during the ESI immediately adjacent to SI samples with elevated PAH concentrations did not contain PAHs or had concentrations below screening criteria at all locations except one. This indicates that elevated PAH concentrations are localized and sporadic.
- Laterally, the sediment containing higher PAH concentrations was located in the near-shore sampling locations rather than within the theoretical maximum shotfall zones.

Regardless of whether or not PAH concentrations detected within the Skeet Range are site-related, both the HHRS and ERS performed as part of the ESI concluded that there were no unacceptable potential risks to human and ecological receptors from exposure to sediment at the Skeet Range.

In summary, based on the results of the soil and surface water characterization activities related to the 2009 SI and the sediment characterization activities associated with both the 2009 SI and 2012 ESI, there were no unacceptable potential risks identified to human health and ecological receptors from exposure to environmental media at the Skeet Range. Although total PAHs were detected above North Carolina regulatory standards in site soil, sediment, and surface water, there is no conclusive evidence that the detected PAHs were associated with Skeet Range activities. In fact, the findings of the WCSD indicated that numerous non-site-related and non-CERCLA-regulated potential PAH sources exist within the Neuse River watershed upstream of the site that may have contributed to the detected PAH concentrations. As a result, no further investigation is warranted at the Former Skeet and Trap Range #1.

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Acronyms and Abbreviations

°F	degree Fahrenheit
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CLEAN	Comprehensive Long-term Environmental Action—Navy
COC	Chemical of Concern
COPC	constituent of potential concern
CR	carcinogenic risk
CTO	Contract Task Order
DoN	Department of the Navy
DOT	Department of Transportation
DRMO	Defense Reutilization and Marketing Office
ERS	ecological risk screening
ESI	Expanded Site Inspection
ESV	Ecological Screening Values
FFA	Federal Facility Agreement
FRCE	Fleet Readiness Center – East
GIS	geographic information system
GPS	global positioning system
HHRS	Human Health Risk Screening
HI	hazard index
HQ	hazard quotient
IDW	investigation-derived waste
MC	munitions constituents
MCAS	Marine Corps Air Station
mg/kg	milligram per kilogram
MRP	Munitions Response Program
MS/MSD	matrix spike/matrix spike duplicate
NAVFAC	Naval Facilities Engineering Command
NOAA	National Oceanic and Atmospheric Administration
NOAEL	no observed adverse effect level
PAH	polycyclic aromatic hydrocarbon
PEC	probable effect concentration
PPE	personal protective equipment
QA	quality assurance
QC	quality control
RSL	regional screening level
SI	Site Inspection
SQG	sediment quality guideline
TAL	target analyte list
TCLP	Toxicity Characteristic Leaching Procedure
TEC	threshold effect concentration
TOC	total organic carbon
UCL	upper confidence limit

USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey

SECTION 1

Introduction

This Expanded Site Inspection (ESI) report presents the results of additional characterization activities to evaluate whether hazardous constituents were released to the environment from historical activities at the Former Skeet and Trap Range #1, located at Marine Corps Air Station (MCAS) Cherry Point, North Carolina (**Figure 1-1**). The Former Skeet and Trap Range #1 (referred to hereafter as the Skeet Range) was used for skeet and trap shooting from 1943 through approximately 1955. Skeet and trap shooting are shotgun target shooting sports where participants attempt to hit clay target disks that have been launched into the air at a variety of angles. Shotgun ammunition is not generally considered military munitions.

Investigation activities at the Skeet Range are part of the Munitions Response Program (MRP), where closed ranges associated with MCAS Cherry Point are investigated in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). An earlier Site Inspection (SI) conducted at the Skeet Range in 2009 recommended additional characterization activities to evaluate potential sources of polycyclic aromatic hydrocarbons (PAHs) within sediment at the site (CH2M HILL, 2010).

This report is prepared under the Naval Facilities Engineering Command (NAVFAC) Atlantic, Comprehensive Long-term Environmental Action – Navy (CLEAN) Contract N62470-08-D-1000, Contract Task Order (CTO) 026, for submittal to NAVFAC Mid-Atlantic Division, MCAS Cherry Point Environmental Affairs Department (EAD), North Carolina Department of Environment and Natural Resources (NCDENR), and U.S. Environmental Protection Agency (USEPA) Region 4. The Navy, EAD, NCDENR, and USEPA work jointly as the MCAS Cherry Point Tier I Partnering Team.

1.1 Objectives and Approach

The objectives of an SI are to:

- Determine whether a release of hazardous wastes or hazardous constituents has occurred from past CERCLA-regulated activities, and, if so,
- Determine whether a suspected release warrants further action

An ESI has generally the same objectives as an SI, but differs in that historical data collected during an earlier SI are not sufficient to draw the release assessment conclusions with sufficient certainty.

This ESI was conducted to further evaluate the presence and potential sources of PAHs at the site, following detections of PAHs in site sediment during the SI. The ESI field activities were performed in February 2012 with the collection of sediment samples from both the Neuse River and Slocum Creek. The ESI was conducted in accordance with the *Sampling and Analysis Plan (Field Sampling Plan and Quality Assurance Project Plan) for Former Skeet and Trap Range #1* (CH2M HILL, 2011), referred to herein as the Work Plan.

To achieve the above objectives, a release assessment evaluation was conducted using both the 2009 SI and 2012 ESI data. The combined data set was compared to conservative, risk-based screening values, and human health and ecological risk screenings were performed to evaluate potential risks to receptors. In addition, a Watershed Contaminated Source Document (WCSD) (**Appendix A**) was completed to identify potential non-site-related sources of PAH contamination in the Neuse River watershed in the vicinity of MCAS Cherry Point.

PAHs, which are a subset of semi-volatile organic compounds (SVOCs), have both natural and anthropogenic sources on a local, regional, and global scale. Anthropogenic sources, which contribute a much greater mass of PAHs to watersheds via stormwater runoff and atmospheric deposition than natural sources (on a global scale), include domestic wood burning, combustion of fossil fuels (e.g., automobile, aircraft, and power plant emissions), tire debris, asphalt pavement, coal-tar and asphalt-based sealcoats, roofing tar, and used motor oil (ATSDR, 1995; Yang et al., 2010). Clay targets are another potential source of PAHs at skeet and trap ranges because PAHs are

sometimes a component of the petroleum pitch used to bind the skeet target (Lobb, 2006). Therefore, PAHs detected at these sites are evaluated from a decision analysis process and risk-based perspective.

1.2 Report Organization

This ESI report is composed of the following sections:

- **Section 1 – Introduction,** provides the project scope and objectives of the ESI and the format for the report organization.
- **Section 2 – Site Background,** provides a general description of the Skeet Range and summarizes the history of the site.
- **Section 3 – Field Investigation Activities,** identifies the technical approach, methods, and operational procedures that were used to execute the field investigation activities.
- **Section 4 – Investigation Results,** summarizes the results of the environmental sampling.
- **Section 5 – Human Health Risk Screening,** evaluates the potential for human health risks associated with exposure to sediment at the Skeet Range.
- **Section 6 – Ecological Risk Screening,** evaluates the potential for ecological risks associated with exposure to sediment at the Skeet Range.
- **Section 7 – Release Assessment Conclusions and Proposed Future Actions,** summarizes the findings of the investigation and provides recommendations for further actions to be taken based on these findings.
- **Section 8 – References**, lists the references cited in the preceding sections.

Legend

- Former Skeet and Trap Range #1
- Theoretical Skeet Shotfall Zone
- Area of Maximum Skeet Shotfall
- Buildings
- Runway
- Base Boundary

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Figure 1-1
Site Location Map
Former Skeet and Trap Range #1
MCAS Cherry Point
North Carolina

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SECTION 2

Site Background

This section presents a summary of regional and site-specific information, including site location, setting, and site history.

2.1 Installation Description

MCAS Cherry Point is a 13,164-acre military reservation located north of the town of Havelock, in southeastern Craven County, North Carolina (**Figure 1-1**). Commissioned in 1942, MCAS Cherry Point currently provides support facilities and services for the Second Marine Aircraft Wing, the Fleet Readiness Center – East (FRCE), Service Support Detachment 21 of the Second Force Service Support Group, the Naval Air Maintenance Training Group Detachment, and the Defense Reutilization and Marketing Office (DRMO). MCAS Cherry Point maintains facilities for training and supporting the Atlantic Fleet Marine Force aviation units and is designated as a primary aviation supply point.

The boundaries of MCAS Cherry Point are the Neuse River to the north, Hancock Creek to the east, North Carolina Highway 101 to the south, and an irregular boundary approximately ¾-mile west of Slocum Creek to the west.

On December 16, 1994, MCAS Cherry Point was scored and ranked by the USEPA for inclusion on the CERCLA (or Superfund) National Priorities List (NPL). Under CERCLA, the Navy acts as the lead agency in partnership with USEPA and NCDENR to manage environmental investigations at the facility. On May 12, 2005, the Navy, USEPA, and NCDENR executed a Federal Facility Agreement (FFA) for MCAS Cherry Point. Although the Skeet Range is not listed in the FFA, this MRP site is considered a part of the MCAS Cherry Point NPL site.

2.2 Former Skeet and Trap Range #1 Description

The Skeet Range is located along the northern boundary of MCAS Cherry Point and is approximately 16 acres in size (**Figure 2-1**). The majority of the site occurs within the Neuse River, whereas the relatively small land portion is heavily wooded with a narrow, sandy beach area along the southern bank of the Neuse River. Concrete debris (possibly associated with Skeet Range structures) is present along the sandy beach area bordering the Neuse River. During the 2009 SI activities, it was observed that the shoreline in the vicinity of the site appears to be an erosional environment. Due to erosion, site features that were located on the shoreline during Skeet Range operations in the 1940s are now located within the Neuse River. Additionally, dead tree trunks with exposed roots were observed to be present in the water near the shoreline, indicating the shoreline had eroded.

The site was used for skeet and trap shooting from 1943 through approximately 1955. Skeet and trap shooting are forms of shotgun target shooting sports where participants attempt to hit clay target disks that have been launched into the air at a variety of angles. Specifically, skeet shooting consists of a shooter moving through a series of eight stations shooting at clay target disks which are launched from elevated towers. Trap shooting consists of a shooter standing at one location shooting at clay target disks launched from a pithouse in front of the shooting station with the top of the pithouse located at surface grade. Shooting was performed with 12-gauge shotguns using number 7-½ lead shot. The Skeet Range was in use before the United States Fish and Wildlife Service (USFWS) regulated the use of lead shot to protect waterfowl from the effects of lead poisoning. Information regarding the quantity of munitions used on this range was not available (United States Army Corps of Engineers [USACE], 2001).

The former shooting stations were located between the present day Air Station golf course and the Neuse River (**Figure 2-1**) in an area that is currently a forested riparian buffer zone. The range was oriented in a north-facing direction with the skeet and trap shotfall zones located within the Neuse River. The maximum and theoretical shotfall zones (areas of shot deposition) were determined for both skeet and trap at the Skeet Range, as shown on **Figure 2-1**. According to the *Range Identification and Preliminary Range Assessment* [USACE], 2001), the Air Station requested six skeet or trap sets and two shotgun flexible mounts on September 8, 1943.

2.2.1 Physical Setting

Proximity to the Atlantic Ocean significantly influences the climate of MCAS Cherry Point. The climate is warm and humid with short, mild winters and long, hot summers. Winter temperatures average 46 degrees Fahrenheit (°F), and those in summer average 77°F. Precipitation is not evenly distributed, with the greatest monthly precipitation occurring during July, August, and September (6 to 8 inches per month). In the other months, monthly rainfall averages 3 to 4 inches. Average precipitation for the Coastal Plain is approximately 50 inches per year (Giese, Eimers, and Coble, 1997).

The regional geologic framework for North Carolina presented here is based principally on information compiled and developed as part of the United States Geological Survey's (USGS) Regional Aquifer-System Analysis. The Coastal Plain Province of North Carolina is underlain by an eastward-thickening wedge of unconsolidated gravel, sand, silt, and clay with scattered beds of shells and loosely consolidated beds of limestone, sandy limestone, and shell limestone (Winner and Coble, 1996).

The soils along the southern bank of the Neuse River at the Skeet Range are predominantly sand with traces of clay. Soils exhibit iron oxide staining, and the clay content of the soil increases moving inland from the Neuse River. The ground elevation at the Skeet Range increases with distance moving inland from the shoreline to approximately 20 feet above the water level of the Neuse River. The dominant sediment type in the river bed is poorly-graded sand. Silt, clay, gravel, organic matter, and shell fragments are also common from 0 to 6 feet below the sediment surface. The sediment is generally firm, uncemented, and homogenous (CH2M HILL, 2010).

The Skeet Range was located approximately 2,000 feet downstream of the confluence of the Neuse River and Slocum Creek. In the vicinity of the Skeet Range, the Neuse River is classified as a Class SB Tidal Salt Water with primary recreation uses, aquatic life propagation and survival, fishing, and wildlife. Slocum Creek is classified as a Class SC Tidal Salt Water, which use is defined as aquatic life propagation and survival, fishing, wildlife, and secondary recreation. Recreational uses of Neuse River include fishing, crabbing, boating, and swimming. Potential current receptors include recreational adult, youth, and children. The current receptors may come in contact with surface soil, surface water, and sediment while swimming, boating, fishing, and crabbing at and near the site. Exposure routes may include incidental ingestion of and dermal contact with these media. Based on the historic site use and expected contaminant exposure associated with the use, the inhalation pathway is not considered a significant contribution to potential risks.

2.2.2 Potential Sources of Contaminant Release

The primary potential release mechanisms associated with skeet and trap ranges include corrosion of the lead shot and from the varying levels of PAHs within the clay targets. A less significant potential release mechanism is propellant detonation from the firing of the shotguns at the firing points.

A literature review was performed as part of this ESI to evaluate the clay target composition during the time frame of the Skeet Range operations, and to determine if PAHs identified in Skeet Range sediment samples are consistent with PAHs used in target binding agents. The findings of the literature review included the following:

- In the late 19th century, Kimble and Stock developed the first modern-day clay targets that were not purely clay. The clay target included coal-tar pitch and was shiny-black in color; targets ever since have a composition based on varying percentages of limestone and pitch. Although the exact composition of each manufacturer's clay targets varies, all clay targets are comprised of a mixture of limestone carbonate, a binding material, and in present-day clay targets, fluorescent paint. Some of the common binding agents include coal-tar pitch, petroleum pitch, asphalt pitch, and fly ash (Hoeger, 2011).
- The various pitch products are used to bind the powdered carbonate into the disc shape and make the targets more durable. Baer (1995) reported the composition of new clay targets as 67% dolomitic limestone, 32% petroleum pitch, and 1% fluorescent aqueous paint (painted targets only). The PAH content varies depending on the type of binder used. A 1998 report of German State Ministers for the Environment describes studies showing the PAH content of clay targets ranging from 3,000 to 40,000 mg/kg of PAHs, depending on the

manufacturer (Lobb, 2006). High molecular weight PAHs are principal chemicals of concern in coal tar and petroleum pitch, which results in clay targets being a potential PAH source (Hoeger, 2011).

- An analysis of the PAH concentrations in the Remington Arms Company Blue Rock® trap and skeet target was performed in 1994 as part of a toxicity evaluation of aquatic test species in the vicinity of a major gun club in the northeast United States (Baer, 1995). The results of the analysis, as shown on **Table 2-1**, indicated that the high molecular weight PAHs (benzo[a]anthracene, benzo[b]fluoranthene, chrysene, benzo[a]pyrene, dibenz[a,h]anthracene) were present within the clay target at the highest concentrations. While these PAHs were detected in Skeet Range sediment samples during the SI and ESI, shooting activities at the Skeet Range occurred 40 to 50 years earlier than the analysis of this 1994 clay target. As a result, there is no way to determine if the PAH constituents of the clay targets actually used at the Skeet Range was similar. In addition, the high molecular weight PAHs present at the highest concentrations in clay targets are consistent with the PAHs seen at the highest concentrations in typical urban environments (Teaf, 2008).

here are also a number of potential residential, commercial, and industrial PAH sources of contamination to the Neuse River from both Navy and non-Navy properties within the Neuse River watershed. The sources with the potential to impact the watershed with PAH constituents include outfalls (storm water and facility discharges), CERCLA sites, RCRA sites, UST sites, land and water transportation activities, coal-tar sealant used on pavement, naturally occurring environmental sources, and illicit discharges. These potential Navy and non-Navy PAH sources are detailed in the Watershed Contaminated Source Document (WCSD) presented in **Appendix A**.

As detailed in the WCSD, the National Oceanic and Atmospheric Administration (NOAA) investigated PAH concentrations along the length of the Neuse River in 1998 and 1999. Results of this investigation revealed that benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene, which are the same PAHs exceeding screening criteria in the Skeet Range samples, also exceeded regional screening levels (RSLs) at various locations along the Neuse River, primarily at locations upstream of the Skeet Range.

2.2.3 Previous Investigations

Environmental investigations and other relevant environmental history prior to the ESI are summarized below.

Initial Assessment

An initial assessment of the Skeet Range was conducted in 2005, which identified the location of the Skeet Range shooting stations and theoretical shotfall zones. Concrete debris was observed in the vicinity of the former shooting station (CH2M HILL, 2005).

Site Inspection

An SI was conducted in May 2009 to evaluate the presence of munitions constituents (MC) and to characterize potential impacts to surface soil, surface water, and sediment related to historical activities at the Skeet Range (CH2M HILL, 2010). A general summary of the SI findings are provided below; a more detailed evaluation of PAHs observed in sediment during the 2009 SI are also provided in Sections 4, 5, and 6 of this ESI.

Field activities included collecting surface soil samples near the Skeet Range firing line, and collecting surface water and sediment samples (to a depth of 6 feet below sediment surface) from within the former shotfall zones and upstream and downstream of the site within the Neuse River. All samples were analyzed for PAHs and target analyte list (TAL) metals. Additionally, surface soil samples were analyzed for perchlorate. To better assess the transport characteristics of potential contaminants across the site, select sediment samples were analyzed for grain size and total organic carbon (TOC) and surface water samples were analyzed for hardness.

In addition to environmental samples, approximately 2 liters of sediment were collected at each sample location and sieved using a stainless steel #16 sieve (equivalent to 1.18 millimeters) to screen for shot particles and clay target fragments. No shot particles or target fragments were observed in the site samples.

Three PAHs (benzo[a]pyrene, benzo[b]fluoranthene, and dibenz[a,h]anthracene) and four metals (aluminum, arsenic, cobalt, and iron) were detected at concentrations that exceeded screening criteria in surface soil. PAH

exceedances were detected at locations behind the firing positions and are therefore not associated with clay target residue due to Skeet Range operations and may be attributable to other anthropogenic or naturally occurring sources. Perchlorate was not detected in any of the surface soil samples.

Five PAHs (benzo[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, dibenz[a,h]anthracene, and indeno[1,2,3-cd]pyrene) and five metals (aluminum, arsenic, cobalt, iron, and manganese) were detected at concentrations that exceeded screening criteria in sediment. All PAH concentration exceedances were detected within the area of the theoretical shotfall zone, with the majority of exceedances located in the first foot of sediment. The detected metals were found at similar concentrations in all of the samples and exceeded screening levels in the background samples collected upstream of the site as well as within and downstream of the shotfall zone. The presence of elevated metals concentrations in the upstream background samples indicates that metals impacts are not likely attributable to historic Skeet Range activities.

Four PAHs (benzo[b]fluoranthene, benzo[k]fluoranthene, dibenz[a,h]anthracene, and indeno[1,2,3-cd]pyrene) and one metal (manganese) were detected at concentrations that exceeded screening criteria in surface water. All PAH concentration exceedances were detected within and downstream of the theoretical shotfall zone. The detected metals were found at the upstream background locations at similar concentrations to those detected within and downstream of the shotfall zone. The presence of elevated metals concentrations in the upstream background samples indicates that metals impacts are not likely attributable to historic Skeet Range activities.

A human health risk screening (HHRS) was performed for surface soil, sediment, and surface water at the Skeet Range. Results of the HHRS indicated that exposure to surface soil and surface water at the Skeet Range would not result in any unacceptable human health risks to current or likely future receptors. However, future exposure to sediment could potentially result in risks above acceptable levels due to PAH and arsenic concentrations. Based on an evaluation of arsenic concentrations in upstream sediment and background surface soil samples, it was determined that arsenic in site sediment was likely not due to Skeet Range operations and that no additional investigation of arsenic concentrations was needed.

An ecological risk screening (ERS) was performed for surface soil, surface water, and sediment at the Skeet Range. Results of the ERS concluded that there are no significant risks anticipated for ecological receptors exposed to these media at the Skeet Range.

Based on the results of the HHRS and ERS, no further evaluation of surface soil and surface water was recommended at the Skeet Range. However, due to potential risks to human receptors associated with PAHs in sediment, an ESI was recommended to further define the source of these contaminants in sediment. Additionally, it was recommended that a Watershed Contaminated Source Document (WCSD) be prepared to evaluate potential sources of PAHs in sediment at the site from non-site-related sources was recommended for the Skeet Range (CH2M HILL, 2010).

TABLE 2-1

Analysis of PAHs Concentration in Clay Targets

Remington Arms Company Blue Rock® trap and skeet targets

Former Skeet and Trap Range #1

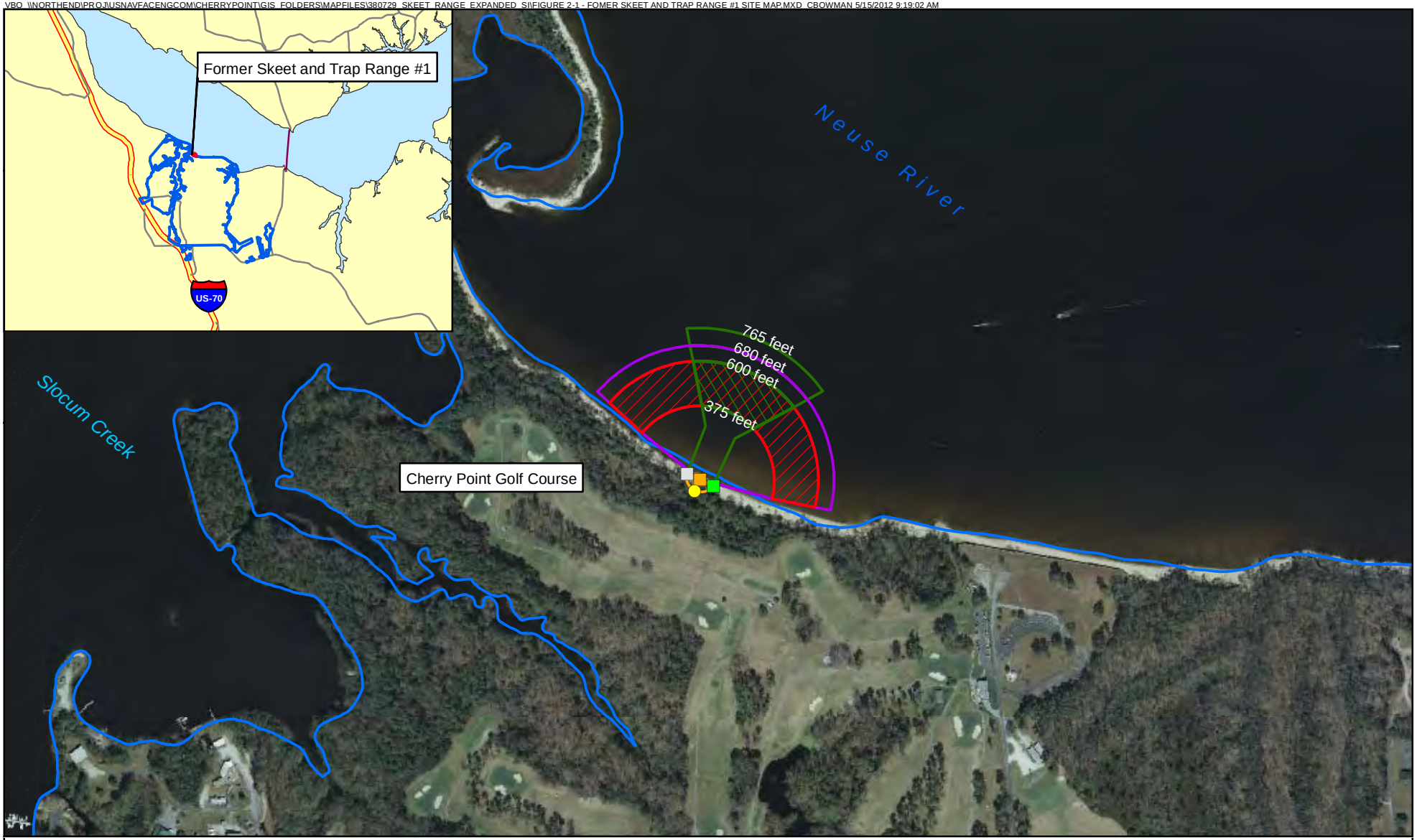
MCAS Cherry Point, North Carolina

Sample ID	HT37-1	*HT98-1	HT99-1	*AVG	*STD	%RSD
Sample weight (grams)	1.11	1.07	1.18	NA	NA	NA
Compound (nanograms/gram)						
Naphthalene	407	379	381	389	13	3
2-Methylnaphthalene	2,614	1,304	2,625	2,181	620	28
1-Methylnaphthalene	1,263	657	1,159	1,026	264	26
Biphenyl	ND	ND	ND	ND	NA	NA
2,6-Dimethylnaphthalene	2,672	1,710	3,023	2,468	555	22
Acenaphthylene	ND	ND	ND	ND	NA	NA
Acenaphthene	223	4,847	294	259	35	14
2,3,5-Trimethylnaphthalene	876	644	1,026	849	157	18
Fluorene	802	4,017	1,052	927	125	13
Phenanthrene	26,377	77,524	39,232	32,805	6,428	20
Anthracene	3,953	10,548	5,851	6,784	2,772	41
1-Methylphenanthrene	12,893	16,192	17,922	15,669	2,085	13
Fluoranthene	10,195	78,455	16,400	13,298	3,102	23
Pyrene	109,191	163,545	179,384	150,707	30,060	20
Benz [a] anthracene	175,991	195,765	241,288	204,348	27,340	13
Chrysene	242,409	238,822	294,660	258,630	25,519	10
Benzo [b] fluoranthene	48,651	78,696	69,464	65,604	12,566	19
Benzo [k] fluoranthene	ND	ND	ND	ND	NA	NA
Benzo [e] pyrene	88,376	122,503	123,207	111,362	16,256	15
Benzo [a] pyrene	69,070	126,759	102,251	99,360	23,640	24
Perylene	19,599	34,193	26,701	26,831	5,959	22
Indeno [1,2,3-c,d] pyrene	4,378	21,577	7,076	11,010	7,553	69
Dibenz [a,h] anthracene	22,242	39,890	32,255	31,463	7,227	23
Total PAH:	855,922	1,237,884	1,183,909	1,092,595	168,748	15

Notes:
AVG: Average
NA: Not Applicable
ND: Not Detected
STD: Standard Deviation
RSD: Relative Standard Deviation
Concentration units are presented in nanograms per gram (dry weight).
*Significant contamination/interference was evident for acenaphthene, fluorene, phenanthrene, and fluoranthene for sample HT98-1. The HT98-1 results for these analytes were therefore not used when calculating the average PAH concentrations.

Reference:

Baer, K.N.; Hutton, D.G.; Boeri, R.L.; Ward, T.J.; Stahl, R.G., 1995: Toxicity evaluation of trap and skeet shooting targets to aquatic test species. Ecotoxicology 4: 385-392.



Legend

- Installation Boundary
- Former Skeet and Trap Range #1
- Theoretical Skeet Shotfall Zone
- Area of Maximum Skeet Shotfall
- Theoretical Trap Shotfall Zone
- Area of Maximum Trap Shotfall
- High House
- Low House
- Control House
- Pit House

N
W E
S

0 350 700
Feet

Figure 2-1
Site Map
Former Skeet and Trap Range #1
MCAS Cherry Point
North Carolina

CH2MHILL

SECTION 3

Field Investigation Activities

This section describes the approach and methodology of the field investigation activities conducted as part of the ESI at the Skeet Range. Sediment samples were collected from the Neuse River and Slocum Creek in February 2012. Specific details of the sampling rationale and objectives are provided in the Work Plan (CH2M HILL, 2011).

3.1 Site Surveying

The spatial coordinates of each sediment sampling location were recorded using a handheld global positioning system (GPS) unit for entry into a geographical information system (GIS) database.

3.2 Sediment Sampling

Eleven sediment samples were collected within the Neuse River and Slocum Creek as shown on **Figure 3-1**. At each location, one sediment sample was collected from the 0-1 foot depth interval using the Vibracore sampling technique and analyzed for PAHs, grain size, and total organic carbon (TOC). Analytical services were provided by Empirical Laboratories, Inc. in Nashville, Tennessee, a North Carolina-certified, Navy-approved laboratory.

Vibracore sediment sampling was conducted by Catlin Engineers and Scientists of Wilmington, North Carolina. Sediment cores were collected using a vibratory coring head constructed from an electric concrete vibrator attached to a metal coring barrel. A polycarbonate core liner was inserted into an aluminum coring barrel and the apparatus was lowered to the sediment surface, at which point the vibratory head was engaged. The coring device was advanced until the target penetration depth had been achieved and a winch was used to move the core to the deck of the sampling platform. The core was brought onboard and the bottom was immediately capped to prevent sample loss. The polycarbonate liner was then removed from the outer barrel and holes were drilled to allow drainage of any overlying water. The core liner was then cut to the length of the core, the top end capped, and each core secured on deck for transport to shore. The cores were transferred to shore for characterization and processing.

Upon transfer to shore, the sediment cores were cut longitudinally using electric slot cutters; the cores were then characterized with respect to gross grain size, sediment type, color, odor, and any other identifying characteristics. The cores were then photographed and prepared for sample collection. To prepare each sample, the sediment was homogenized until a uniform color and texture was achieved, and the sample was then containerized for shipment to the laboratory. Sample containers were placed on ice immediately after collection. Material in direct contact with the aluminum core barrel was not collected for chemical analyses. Sediment core boring logs are presented in **Appendix B**.

3.3 Quality Assurance/Quality Control Sampling

Appropriate quality assurance/quality control (QA/QC) sampling was performed in accordance with the Work Plan (CH2M HILL, 2011), including the collection of temperature blanks, field blanks, equipment blanks, duplicates, and matrix spike/matrix spike duplicates (MS/MSDs).

3.4 Environmental Data and Management

Information on the evaluation of the analytical data collected during the ESI with respect to meeting the Navy's Data Quality Objectives as described in the Work Plan (CH2M HILL, 2011), is discussed below.

3.4.1 Data Tracking and Validation

Sample identifications and the required analytical tests were recorded on chain-of-custody forms, which accompanied the samples to the laboratory. Chain-of-custody entries were checked against the project instructions to verify that all designated samples were collected and submitted for the appropriate analyses. Upon receipt of the samples by the laboratory, a comparison to the field information was made to verify that each

sample was analyzed for the correct parameters. In addition, a check was made to ensure that the appropriate number and types of QA/QC samples were collected.

Data validation was performed internally by CH2M HILL. The procedures used for the validation process included *National Functional Guidelines for Superfund Organic Methods Data Review* (USEPA, 2008).

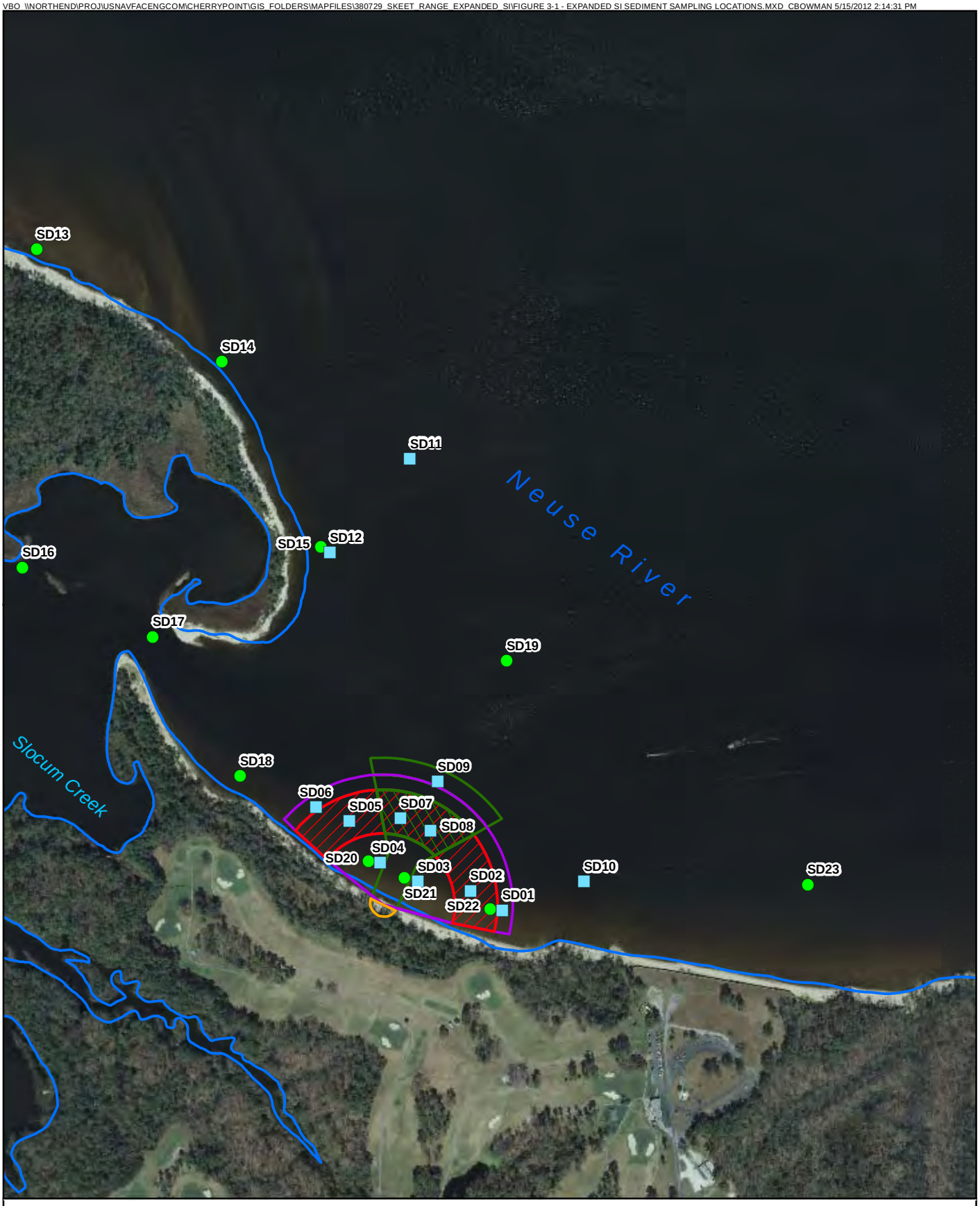
3.4.2 Risk-Based Screening Values

The screening process used to identify potential risks to human and ecological receptors and to classify a constituent as a Chemical of Concern (COC) is discussed in Sections 5 and 6. However, to determine the nature of contamination within sediment at the Skeet Range, each analyte was compared to the following risk-based screening values:

- USEPA Regional Screening Levels (RSLs) for Residential Soil (May 2012), adjusted as appropriate
- Ecological Screening Values

3.5 Investigation-derived Waste Management

Investigation-derived waste (IDW) consisted of sediment cuttings from the Vibracore borings, liquid waste (for example, decontamination fluids), disposable sampling equipment, and personal protective equipment (PPE). With the exception of liquid waste, all IDW generated during the ESI was managed in accordance with the Work Plan (CH2M HILL, 2011). Liquid waste was disposed of at the MCAS Cherry Point industrial wastewater treatment facility at the direction of MCAS Cherry Point Environmental Affairs Department personnel. Sediment cuttings from Vibracore borings were containerized in a labeled, Department of Transportation (DOT)-approved 55-gallon drum. CH2M HILL collected representative samples of the sediment IDW in order to determine disposal requirements and method of transport to the proper disposal facilities. Toxicity Characteristic Leaching Procedure (TCLP) results indicated that all chemical constituents were below detection limits or were detected at low concentrations; therefore, the sediment was characterized as non-hazardous waste. The IDW was removed from MCAS Cherry Point by A&D Environmental Services Inc. on May 24, 2012, and was disposed of on June 14, 2012 at the EQ Florida facility located at 2002 North Orient Road, Tampa, Florida. The IDW analytical results and waste manifest are presented in **Appendix C**. PPE, disposable sampling equipment, and other trash generated during field activities were placed in heavy plastic garbage bags, tied securely, and disposed of as municipal trash.



Legend

- 2009 SI Sediment Sample Location
- 2012 ESI Sediment Sample Location
- Theoretical Trap Shotfall Zone
- Area of Maximum Trap Shotfall
- Former Skeet and Trap Range #1
- Theoretical Skeet Shotfall Zone
- Area of Maximum Skeet Shotfall
- Installation Boundary

N
W E
S

0 350 700
Feet

Figure 3-1
Sediment Sampling Locations
Former Skeet and Trap Range #1
MCAS Cherry Point
North Carolina

CH2MHILL

SECTION 4

Investigation Results

This section presents a summary of the analytical results of sediment samples collected from both the 2009 SI and the 2012 ESI. The number and spatial distribution of sediment samples provides sufficient coverage of the environmental media at the site to assess the potential for a CERCLA-regulated release.

Sediment data collected during the 2012 ESI (samples collected at 0-1 foot below sediment surface) was evaluated along with the 2009 SI sediment data collected from the same depth interval to provide a comprehensive overview of PAH concentrations in and around the site. Twelve surface sediment samples were collected during the 2009 SI (SD01 through SD12), and 11 sediment samples were collected during the 2012 ESI (SD13 through SD23). Constituent concentrations detected above screening criteria in sediment samples from the 2009 SI and 2012 ESI are presented in **Table 4-1** and **Table 4-2**, respectively, and on **Figure 4-1**. Raw analytical data for the 2012 Expanded SI data are presented in **Appendix D**. No visual evidence of lead pellets or clay targets were observed at any sampling location during the SI or ESI.

Ten PAH compounds were observed in sediment above ecological screening values, and five PAH compounds in sediment exceeded the adjusted RSLs for residential soil at one or more sample locations in the combined 2009 and 2012 data set. Samples with PAH compounds exceeding these screening values were located within and immediately upstream of the theoretical skeet and trap shotfall zones. The maximum PAH concentrations were detected at SI sampling location SD01 with the following results: benzo(a)anthracene at 590 micrograms per kilogram (µg/kg); benzo(a)pyrene at 1,400 µg/kg; benzo(b)fluoranthene at 1,900 µg/kg; and indeno(1,2,3-cd)pyrene at 790 µg/kg.

The highest PAH concentrations were generally detected in samples collected relatively close to the shoreline, both within the Skeet Range site boundary (SD01, SD03, SD04, and SD20) and upstream (SD18). Several samples from the SI and ESI were located in close proximity to one another (SD01/SD22, SD03/SD21, SD04/SD20, and SD12/SD15). Although PAH concentrations above screening criteria were detected during the SI at SD01 and SD03, PAH concentrations were either not detected or detected at concentrations below screening criteria immediately adjacent to these locations during the ESI (SD21 and SD22) (**Figure 4-1**). Additionally, elevated PAH concentrations were observed at SD20 in 2012, while significantly lower PAH concentrations were detected near this location at SD04 in 2009. PAHs were not detected above screening criteria in downstream samples SD10 and SD23.

TABLE 4-1

2009 Sediment PAH Results

Former Skeet and Trap Range #1

MCAS Cherry Point, North Carolina

Station ID	**Adjusted Residential RSL**	**Ecological Marine Screening Values**	STR01-SD01	STR01-SD02	STR01-SD03		STR01-SD04	STR01-SD05	STR01-SD06	STR01-SD07
Sample ID			STR01-SD01-0-1-0509	STR01-SD02-0-1-0509	STR01-SD03-0-1-0509	STR01-SD03-P-0-1-0509	STR01-SD04-0-1-0509	STR01-SD05-0-1-0509	STR01-SD06-0-1-0509	STR01-SD07-0-1-0509
Sample Depth			0-1 feet	0-1 feet	0-1 feet	0-1 feet	0-1 feet	0-1 feet	0-1 feet	0-1 feet
Sample Date			05/21/09	05/21/09	05/21/09	05/21/09	05/21/09	05/21/09	05/21/09	05/21/09
Chemical Name										
Semivolatile Organic Compounds (µg/kg)										
2-Methylnaphthalene	23,000	20.2	4.8 J	86 U	83 U	92 U	74 U	73 U	79 U	76 U
Acenaphthene	340,000	6.4	13 J	86 U	83 U	15 J	2 J	73 U	79 U	76 U
Anthracene	1,700,000	46.9	17 J	86 U	83 U	92 U	8.9 J	73 U	7.6 J	76 U
Benzo(a)anthracene	150	88.8	**590**	9.8 U	5.7 U	**320**	56 J	4.5 U	11 U	5.1 U
Benzo(a)pyrene	15	88.8	**1,400**	13	7.8 J	**370 J**	**120**	6.8 J	13	7.6 U
Benzo(b)fluoranthene	150	--	**1,900**	15 J	7.2 J	**470 J**	**160**	6.3 J	13 J	76 U
Benzo(g,h,i)perylene	170,000	--	800	7.4 J	3.4 J	240 J	120	3.1 J	7.3 J	76 U
Benzo(k)fluoranthene	1,500	--	550	10 J	8.4 J	92 U	38 J	7.3 J	10 J	7.6 J
Chrysene	15,000	108	670	2 J	83 U	340	55 J	73 U	3.3 J	76 U
Dibenz(a,h)anthracene	15	6.22	8.3 U	8.6 U	8.3 U	**36**	7.4 U	7.3 U	7.9 U	7.6 U
Fluoranthene	230,000	113	300	17 J	3.9 U	420	74	3.3 U	10 U	3.5 J
Fluorene	230,000	21.2	14 J	6.5 J	83 U	12 J	6.2 J	5.4 J	6.6 J	76 U
Indeno(1,2,3-cd)pyrene	150	--	**790**	86 U	83 U	**230**	**110**	73 U	79 U	4.8 J
Naphthalene	3,600	34.6	18 J	86 U	83 U	6.6 J	74 U	73 U	79 U	76 U
Phenanthrene	1,700,000	86.7	39 J	5 J	83 U	110	19 J	73 U	2.8 J	76 U
Pyrene	170,000	153	370	12 J	2.1 J	380 J	72 J	1.7 J	7.3 J	1.8 J
Wet Chemistry										
Total organic carbon (TOC) (mg/kg)			NA	NA	NA	NA	770 J	NA	NA	990 J

Notes:

J - Analyte present, value may or may not be accurate or precise

U - The material was analyzed for, but not detected

NA - Not Analyzed

mg/kg - Milligrams per kilogram

µg/kg - Micrograms per kilogram

RSL - Regional Screening Level

"P" in sample ID indicates duplicate sample

Shading indicates detection

Bold text indicates adjusted RSL exceedance

Red text indicates eco exceedance

Bold and red text indicates adjusted RSL and eco exceedance

TABLE 4-1

2009 Sediment PAH Results

Former Skeet and Trap Range #1

MCAS Cherry Point, North Carolina

Station ID	STR01-SD08	STR01-SD09		STR01-SD10	STR01-SD11	STR01-SD12
Sample ID	STR01-SD08-0-1-0509	STR01-SD09-0-1-0509	STR01-SD09-P-0-1-0509	STR01-SD10-0-1-0509	STR01-SD11-0-1-0509	STR01-SD12-0-1-0509
Sample Depth	0-1 feet	0-1 feet	0-1 feet	0-1 feet	0-1 feet	0-1 feet
Sample Date	05/21/09	05/21/09	05/21/09	05/21/09	05/21/09	05/21/09
Chemical Name						
Semivolatile Organic Compounds (µg/kg)						
2-Methylnaphthalene	84 U	110 U	110 U	81 U	83 U	2.8 J
Acenaphthene	84 U	110 U	110 U	81 U	83 U	86 U
Anthracene	6.9 J	110 U	11 J	6.5 J	6.6 J	86 U
Benzo(a)anthracene	5.6 U	12 U	12 U	5.3 U	5.1 U	5.9 U
Benzo(a)pyrene	8.3 J	**19**	**16**	8.1 U	8.3 U	8.6 U
Benzo(b)fluoranthene	7.9 J	20 J	16 J	6.7 J	83 U	7.1 J
Benzo(g,h,i)perylene	4 J	13 J	8.6 J	81 U	3.2 J	86 U
Benzo(k)fluoranthene	8.6 J	14 J	14 J	8 J	83 U	86 U
Chrysene	84 U	2.1 J	110 U	81 U	83 U	86 U
Dibenz(a,h)anthracene	8.4 U	8.7 J	11 U	8.1 U	8.3 U	8.6 U
Fluoranthene	4.6 U	13 U	16 J	3.4 U	3.3 U	3.8 U
Fluorene	6.3 J	110 U	110 U	6 J	6.1 J	6.8 J
Indeno(1,2,3-cd)pyrene	84 U	110 U	110 U	81 U	83 U	86 U
Naphthalene	84 U	110 U	110 U	81 U	83 U	3.6 J
Phenanthrene	84 U	3.4 J	6.9 J	81 U	83 U	86 U
Pyrene	2.8 J	11 J	12 J	81 U	83 U	86 U
Wet Chemistry						
Total organic carbon (TOC) (mg/kg)	NA	9,200	6,780	NA	1,430 J	1,780

Notes:

J - Analyte present, value may or may not be accurate or precise

U - The material was analyzed for, but not detected

NA - Not Analyzed

mg/kg - Milligrams per kilogram

µg/kg - Micrograms per kilogram

RSL - Regional Screening Level

"P" in sample ID indicates duplicate sample

Shading indicates detection

Bold text indicates adjusted RSL exceedance

Red text indicates eco exceedance

Bold and red text indicates adjusted RSL and eco exceedance

TABLE 4-2

2012 Sediment Analytical Results

Former Skeet and Trap Range #1

MCAS Cherry Point, North Carolina

Sample ID	Adjusted Residential RSL	Ecological Marine Screening Values	STR1-SD13-0-1-0212	STR1-SD13D-0-1-0212	STR1-SD14-0-1-0212	STR1-SD15-0-1-0212	STR1-SD16-0-1-0212	STR1-SD17-0-1-0212	STR1-SD18-0-1-0212	STR1-SD19-0-1-0212
Sample Date			2/7/12	2/7/12	2/7/12	2/7/12	2/7/12	2/7/12	2/7/12	2/7/12
Chemical Name										
Semivolatile Organic Compounds (µg/kg)										
2-Methylnaphthalene	23,000	20.2	3.95 U	4.04 U	4.2 U	4.26 U	4.22 U	5.04 U	2.53 J	4.4 U
Acenaphthene	340,000	6.4	3.95 U	4.04 U	4.2 U	4.26 U	4.22 U	5.04 U	7.84 J	4.4 U
Anthracene	1,700,000	46.9	3.95 U	4.04 U	4.2 U	4.26 U	4.22 U	5.04 U	13.4	4.4 U
Benzo(a)anthracene	150	88.8	3.95 U	4.04 U	4.2 U	4.26 U	4.22 U	5.04 U	**176**	4.4 U
Benzo(a)pyrene	15	88.8	2.78 J	3.6 J	4.2 U	4.26 U	4.22 U	5.04 U	**228**	3.13 J
Benzo(b)fluoranthene	150	--	3.95 U	3.63 J	4.2 U	4.26 U	4.22 U	5.04 U	**209**	4.4 U
Benzo(g,h,i)perylene	170,000	--	2.28 J	2.32 J	4.2 U	4.26 U	4.22 U	5.04 U	155	2.77 J
Benzo(k)fluoranthene	1,500	--	3.95 U	3.68 J	4.2 U	4.26 U	4.22 U	5.04 U	197	4.4 U
Chrysene	15,000	108	3.95 U	4.04 U	4.2 U	4.26 U	4.22 U	5.04 U	218	4.4 U
Dibenz(a,h)anthracene	15	6.22	3.95 U	4.04 U	4.2 U	4.26 U	4.22 U	5.04 U	**49.2**	4.4 U
Fluoranthene	230,000	113	3.14 J	7.37 J	4.2 U	4.26 U	4.22 U	5.04 U	198	6.6 J
Fluorene	230,000	21.2	3.95 U	4.04 U	4.2 U	4.26 U	4.22 U	5.04 U	4.4 J	4.4 U
Indeno(1,2,3-cd)pyrene	150	--	3.95 U	4.04 U	4.2 U	4.26 U	4.22 U	5.04 U	147	2.46 J
Naphthalene	3,600	34.6	3.95 U	4.04 U	4.2 U	4.26 U	4.22 U	5.04 U	3.97 U	4.4 U
Phenanthrene	1,700,000	86.7	2.36 J	2.63 J	4.2 U	4.26 U	4.22 U	5.04 U	54	2.94 J
Pyrene	170,000	153	2.61 J	6.22 J	4.2 U	4.26 U	4.22 U	5.04 U	189	5.25 J
Wet Chemistry (MG/KG)										
Total Organic Carbon (TOC)			754	NS	1,860	2,060	2,420	8,390	2,070	4,510
Grain Size (PCT)										
Coarse Sand (%)			0.00E+00	NS	6	1	2	2	4	0.00E+00
Fine Sand (%)			78	NS	44	61	22	22	63	6
Fines (%)			22	NS	41	30	10	10	21	94
Gravel (%)			0.00E+00	NS	0.00E+00	0.00E+00	1	1	0.00E+00	0.00E+00
GS03 Sieve 3" (75 mm)			100	NS	100	100	100	100	100	100
GS05 Sieve 2" (50 mm)			100	NS	100	100	100	100	100	100
GS06 Sieve 1.5" (37.5 mm)			100	NS	100	100	100	100	100	100
GS07 Sieve 1" (25.0 mm)			100	NS	100	100	100	100	100	100
GS08 Sieve 0.75" (19.0 mm)			100	NS	100	100	100	100	100	100
GS10 Sieve 0.375" (9.5 mm)			100	NS	100	100	100	100	100	100
Medium Sand (%)			0.00E+00	NS	9	8	65	65	12	0.00E+00
Sieve No. 004 (4.75 mm)			100	NS	100	100	99	99	100	100
Sieve No. 010 (2.00 mm)			100	NS	99	99	99	99	99	100
Sieve No. 020 (850 um)			100	NS	94	98	97	97	96	100
Sieve No. 040 (425 um)			100	NS	85	90	32	32	84	99
Sieve No. 060 (250 um)			70	NS	79	78	18	18	70	99
Sieve No. 080 (180 um)			31	NS	48	32	12	12	22	97
Sieve No. 100 (150 um)			22	NS	41	30	10	10	21	94
Sieve No. 200 (75 um)			3	NS	3	6	4	4	2	12

Notes:

J - Analyte present. Value may or may not be accurate or precise

MG/KG - Milligrams per kilogram

µg/kg - micrograms per kilogram

NS - Not sampled

PCT - Percent

PCT/P - Percent Passed

U - The material was analyzed for, but not detected

Shading indicates detection

Bold text indicates RSL exceedance

Red text indicates eco exceedance

Bold and red text indicates adjusted RSL and eco exceedance

TABLE 4-2

2012 Sediment Analytical Results

Former Skeet and Trap Range #1

MCAS Cherry Point, North Carolina

Sample ID	STR1-SD20-0-1-0212	STR1-SD21-0-1-0212	STR1-SD22-0-1-0212	STR1-SD23-0-1-0212	STR1-SD23D-0-1-0212
Sample Date	2/7/12	2/7/12	2/7/12	2/7/12	2/7/12
Chemical Name					
Semivolatile Organic Compounds (µg/kg)					
2-Methylnaphthalene	8.75	3.88 U	4.05 U	3.99 U	4.03 U
Acenaphthene	43.6	3.88 U	4.05 U	3.99 U	4.03 U
Anthracene	104	3.88 U	4.05 U	3.99 U	4.03 U
Benzo(a)anthracene	**923**	3.88 U	4.05 U	3.99 U	4.03 U
Benzo(a)pyrene	**776**	3.88 U	4.05 U	3.99 U	4.03 U
Benzo(b)fluoranthene	**715**	3.88 U	4.05 U	3.99 U	4.03 U
Benzo(g,h,i)perylene	371	3.88 U	4.05 U	3.99 U	4.03 U
Benzo(k)fluoranthene	653	3.88 U	4.05 U	3.99 U	4.03 U
Chrysene	964	3.88 U	4.05 U	3.99 U	4.03 U
Dibenz(a,h)anthracene	**133**	3.88 U	4.05 U	3.99 U	4.03 U
Fluoranthene	1200	4.93 J	4.05 U	3.99 U	4.03 U
Fluorene	21.9	3.88 U	4.05 U	3.99 U	4.03 U
Indeno(1,2,3-cd)pyrene	**399**	3.88 U	4.05 U	3.99 U	4.03 U
Naphthalene	28.3	3.88 U	4.05 U	3.99 U	4.03 U
Phenanthrene	397	3.41 J	4.05 U	3.99 U	4.03 U
Pyrene	1010	4.27 J	4.05 U	3.99 U	4.03 U
Wet Chemistry (MG/KG)					
Total Organic Carbon (TOC)	1,520	2,780	1,950	1,540	NS
Grain Size (PCT)					
Coarse Sand (%)	1	2	10	0.00E+00	NS
Fine Sand (%)	62	63	60	62	NS
Fines (%)	19	26	20	7	NS
Gravel (%)	0.00E+00	0.00E+00	1	0.00E+00	NS
GS03 Sieve 3" (75 mm)	100	100	100	100	NS
GS05 Sieve 2" (50 mm)	100	100	100	100	NS
GS06 Sieve 1.5" (37.5 mm)	100	100	100	100	NS
GS07 Sieve 1" (25.0 mm)	100	100	100	100	NS
GS08 Sieve 0.75" (19.0 mm)	100	100	100	100	NS
GS10 Sieve 0.375" (9.5 mm)	100	100	100	100	NS
Medium Sand (%)	18	9	9	31	NS
Sieve No. 004 (4.75 mm)	100	100	99	100	NS
Sieve No. 010 (2.00 mm)	100	99	95	100	NS
Sieve No. 020 (850 um)	99	98	89	100	NS
Sieve No. 040 (425 um)	81	89	80	69	NS
Sieve No. 060 (250 um)	48	56	57	22	NS
Sieve No. 080 (180 um)	27	31	57	10	NS
Sieve No. 100 (150 um)	19	27	20	7	NS
Sieve No. 200 (75 um)	0.00E+00	7	7	2	NS

Notes:

J - Analyte present. Value may or may not be accurate or precise

MG/KG - Milligrams per kilogram

µg/kg - micrograms per kilogram

NS - Not sampled

PCT - Percent

PCT/P - Percent Passed

U - The material was analyzed for, but not detected

Shading indicates detection

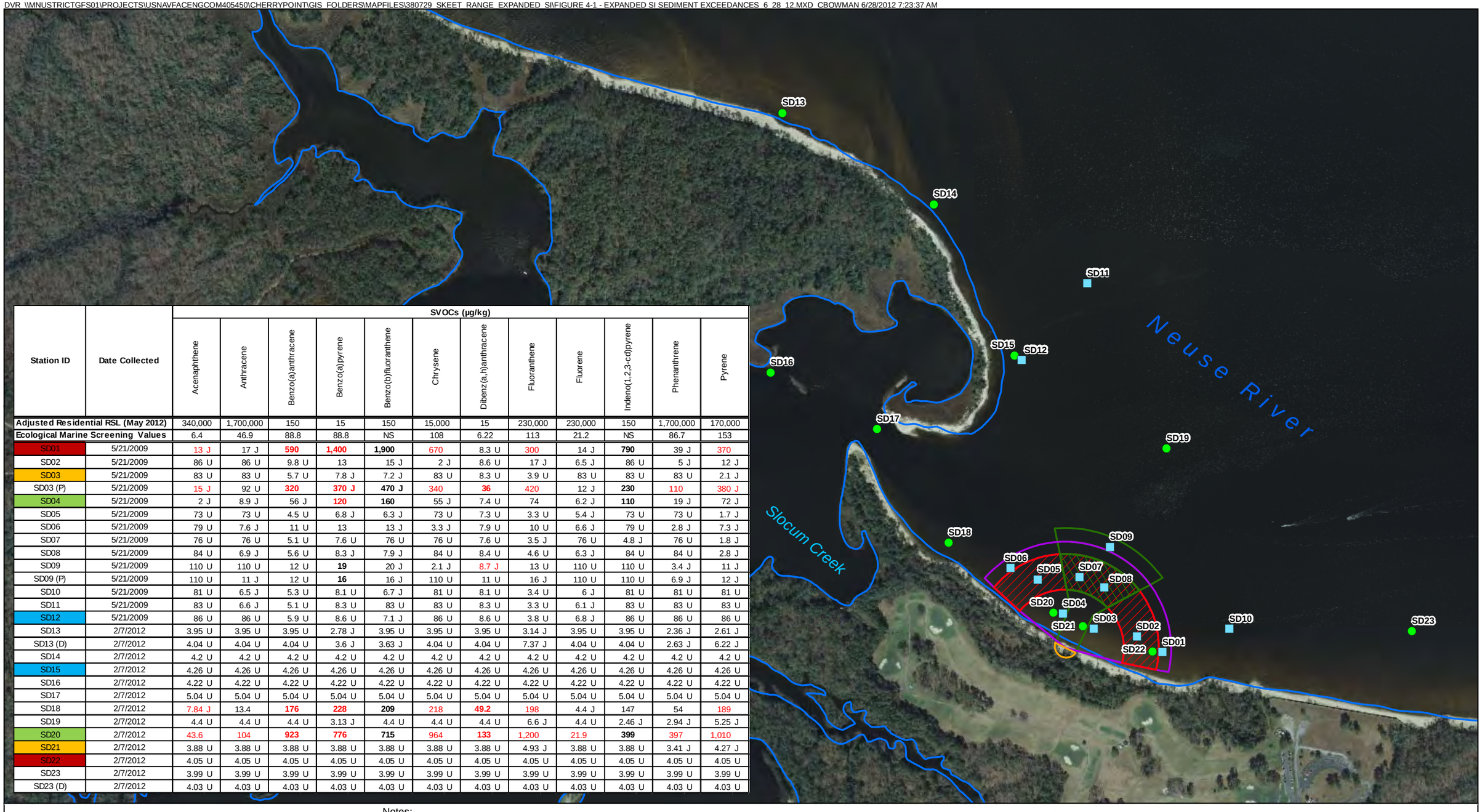
Bold text indicates RSL exceedance

Red text indicates eco exceedance

Bold and red text indicates adjusted RSL and eco exceedance

DVR \\MNUSTRICTGFS01\PROJECTS\USNAVFACENGCOM405450\CHERRYPOINT\GIS_FOLDERS\MAPFILES\380729_SKEET_RANGE_EXPANDED_SI\FIGURE 4-1 - EXPANDED SI SEDIMENT EXCEEDANCES_6_28_12.MXD CBOWMAN 6/28/2012 7:23:37 AM

Station ID	Date Collected	SVOCs (µg/kg)											
		Acenaphthene	Anthracene	Benzo(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-cd)pyrene	Phenanthrene	Pyrene
Adjusted Residential RSL (May 2012)		340,000	1,700,000	150	15	150	15,000	15	230,000	230,000	150	1,700,000	170,000
Ecological Marine Screening Values		6.4	46.9	88.8	88.8	NS	108	6.22	113	21.2	NS	86.7	153
SD01	5/21/2009	13 J	17 J	**590**	**1,400**	**1,900**	670	8.3 U	300	14 J	**790**	39 J	370
SD02	5/21/2009	86 U	86 U	9.8 U	13	15 J	2 J	8.6 U	17 J	6.5 J	86 U	5 J	12 J
SD03	5/21/2009	83 U	83 U	5.7 U	7.8 J	7.2 J	83 U	8.3 U	3.9 U	83 U	83 U	83 U	2.1 J
SD03 (P)	5/21/2009	15 J	92 U	**320**	**370 J**	**470 J**	340	**36**	420	12 J	**230**	110	380 J
SD04	5/21/2009	2 J	8.9 J	56 J	**120**	**160**	55 J	7.4 U	74	6.2 J	**110**	19 J	72 J
SD05	5/21/2009	73 U	73 U	4.5 U	6.8 J	6.3 J	73 U	7.3 U	3.3 U	5.4 J	73 U	73 U	1.7 J
SD06	5/21/2009	79 U	7.6 J	11 U	13	13 J	3.3 J	7.9 U	10 U	6.6 J	79 U	2.8 J	7.3 J
SD07	5/21/2009	76 U	76 U	5.1 U	7.6 U	76 U	76 U	7.6 U	3.5 J	76 U	4.8 J	76 U	1.8 J
SD08	5/21/2009	84 U	6.9 J	5.6 U	8.3 J	7.9 J	84 U	8.4 U	4.6 U	6.3 J	84 U	84 U	2.8 J
SD09	5/21/2009	110 U	110 U	12 U	**19**	20 J	2.1 J	8.7 J	13 U	110 U	110 U	3.4 J	11 J
SD09 (P)	5/21/2009	110 U	11 J	12 U	**16**	16 J	110 U	11 U	16 J	110 U	110 U	6.9 J	12 J
SD10	5/21/2009	81 U	6.5 J	5.3 U	8.1 U	6.7 J	81 U	8.1 U	3.4 U	6 J	81 U	81 U	81 U
SD11	5/21/2009	83 U	6.6 J	5.1 U	8.3 U	83 U	83 U	8.3 U	3.3 U	6.1 J	83 U	83 U	83 U
SD12	5/21/2009	86 U	86 U	5.9 U	8.6 U	7.1 J	86 U	8.6 U	3.8 U	6.8 J	86 U	86 U	86 U
SD13	2/7/2012	3.95 U	3.95 U	3.95 U	2.78 J	3.95 U	3.95 U	3.95 U	3.14 J	3.95 U	3.95 U	2.36 J	2.61 J
SD13 (D)	2/7/2012	4.04 U	4.04 U	4.04 U	3.6 J	3.63 J	4.04 U	4.04 U	7.37 J	4.04 U	4.04 U	2.63 J	6.22 J
SD14	2/7/2012	4.2 U	4.2 U	4.2 U	4.2 U	4.2 U	4.2 U	4.2 U	4.2 U	4.2 U	4.2 U	4.2 U	4.2 U
SD15	2/7/2012	4.26 U	4.26 U	4.26 U	4.26 U	4.26 U	4.26 U	4.26 U	4.26 U	4.26 U	4.26 U	4.26 U	4.26 U
SD16	2/7/2012	4.22 U	4.22 U	4.22 U	4.22 U	4.22 U	4.22 U	4.22 U	4.22 U	4.22 U	4.22 U	4.22 U	4.22 U
SD17	2/7/2012	5.04 U	5.04 U	5.04 U	5.04 U	5.04 U	5.04 U	5.04 U	5.04 U	5.04 U	5.04 U	5.04 U	5.04 U
SD18	2/7/2012	7.84 J	13.4	**176**	**228**	**209**	218	**49.2**	198	4.4 J	147	54	189
SD19	2/7/2012	4.4 U	4.4 U	4.4 U	3.13 J	4.4 U	4.4 U	4.4 U	6.6 J	4.4 U	2.46 J	2.94 J	5.25 J
SD20	2/7/2012	43.6	104	**923**	**776**	**715**	964	**133**	1,200	21.9	**399**	397	1,010
SD21	2/7/2012	3.88 U	3.88 U	3.88 U	3.88 U	3.88 U	3.88 U	3.88 U	4.93 J	3.88 U	3.88 U	3.41 J	4.27 J
SD22	2/7/2012	4.05 U	4.05 U	4.05 U	4.05 U	4.05 U	4.05 U	4.05 U	4.05 U	4.05 U	4.05 U	4.05 U	4.05 U
SD23	2/7/2012	3.99 U	3.99 U	3.99 U	3.99 U	3.99 U	3.99 U	3.99 U	3.99 U	3.99 U	3.99 U	3.99 U	3.99 U
SD23 (D)	2/7/2012	4.03 U	4.03 U	4.03 U	4.03 U	4.03 U	4.03 U	4.03 U	4.03 U	4.03 U	4.03 U	4.03 U	4.03 U



Legend

- 2009 SI Sediment Sample Location
- 2012 ESI Sediment Sample Location
- Theoretical Trap Shotfall Zone
- Area of Maximum Trap Shotfall
- Former Skeet and Trap Range #1
- Theoretical Skeet Shotfall Zone
- Area of Maximum Skeet Shotfall
- Installation Boundary

Notes:
Analytical results presented are for the 0 to 1 foot sediment interval
Bold and red indicates exceedances of the adjusted RSLs and Ecological Marine Screening Values
Bold indicates exceedance of the adjusted RSLs
Red indicates exceedance of the Ecological Marine Screening Values
J - Analyte present, value may or may not be accurate or precise
U - The material was analyzed for, but not detected
NS - No standard
µg/kg - Micrograms per kilogram
P, D - indicates a duplicate sample
Refer to Tables 4-1 and 4-2 for detected concentrations not included on this figure.
The sample number color coding indicates samples located in close proximity to one another.

N
W E
S

0 300 600 1,200
Feet

Figure 4-1
Sediment Data Exceeding Screening Criteria
Former Skeet and Trap Range #1
MCAS Cherry Point
North Carolina

CH2MHILL

SECTION 5

Human Health Risk Screening

This section summarizes the results of the HHRS evaluation of the sediment data collected as part of the SI and ESI. The HHRS was performed in a phased approach, as described below. HHRS tables are provided in **Appendix E**.

A previous HHRS was performed for the Skeet Range as part of the SI Report (CH2M HILL, 2010). The HHRS provided a preliminary indication of unacceptable potential risks from constituents of potential concern (COPCs) due to concentrations of PAHs. Surface soil, sediment and surface water were evaluated in the SI HHRS. No unacceptable risk was identified for surface soil and surface water, so they were eliminated from further consideration. The SI HHRS did identify unacceptable potential risk for PAHs in sediment. Further evaluation of sediment at the Skeet Range was recommended to investigate the sources of PAHs in sediment, which led to the additional sediment sampling performed as part of the ESI.

5.1 Data Evaluation

Five sediment samples collected in 2012 for this ESI, combined with ten sediment samples collected in 2009 as part of the SI, were evaluated in the HHRS. These samples were determined to have potentially been impacted by Skeet Range operations based on their locations. Background samples were excluded as they were not considered to be representative of Skeet Range site sediment concentrations. Samples included in the HHRS are listed in **Appendix F, Table F-1**.

The data included in the HHRS were all validated. A review of the data identified the following criteria for data usability:

- Data qualified with an R (rejected) were not used in the HHRS.
- Estimated values flagged with a J qualifier were treated as detected concentrations.
- For duplicate samples, the maximum concentration between the two results was used as the sample concentration.

5.1.1 Risk Screening Approach

The HHRS was conducted in three steps using a risk ratio technique (Navy, 2000). If COPCs were identified after Step 1, the COPCs were evaluated in Step 2. If COPCs were identified after Step 2, the COPCs were evaluated in Step 3. The three-step screening process is described below:

Step 1

The maximum-detected constituent concentrations in the sediment samples were compared to USEPA residential soil Regional Screening Levels (RSLs; USEPA, 2012) and the site-specific upstream/background samples. RSLs based on noncarcinogenic effects were divided by 10 to account for exposure to multiple chemicals (i.e., were adjusted to a hazard quotient [HQ] of 0.1 from the HQ of 1.0 used on the USEPA RSL table). RSLs based on carcinogenic endpoints were used as presented in the RSL table and are based on a carcinogenic risk (CR) of 1×10^{-6}. Although the site is not currently residential, and future residential use is unlikely, the residential RSLs were used for the screening as they are the most conservative and, therefore, most protective of all current and potential future site uses.

Following USEPA Region 4 guidance (USEPA, 2000), if one constituent from a class of compounds (for example, a carcinogenic PAH) was identified as a COPC, all detected constituents in that class of compounds were retained as COPCs.

The detection limits for the non-detected constituents were also compared to the screening levels discussed above. However, if the detection limits exceeded the screening levels, the constituents were not selected as COPCs.

If the maximum-detected concentration of a constituent in sediment exceeded the appropriate screening value, the constituent was found to be a COPC and the screening level risk evaluation proceeded to Step 2.

Step 2

For analytes identified as COPCs in Step 1, a corresponding risk level was calculated using the following equation:

$$corresponding\ risk\ level = \frac{concentration \times acceptable\ risk\ level}{RSL}$$

The concentration used in the equation is the maximum-detected concentration (the same concentration that was used in Step 1). The acceptable risk level is 1 for noncarcinogens and 10^{-6} for carcinogens. RSLs for noncarcinogenic effects were not adjusted by 10 as was done in Step 1, they are used as presented in the RSL table.

The corresponding risk levels for each analyte within sediment were summed to calculate the cumulative corresponding hazard index (HI) (for noncarcinogens) and cumulative corresponding carcinogenic risk (for carcinogens). A cumulative corresponding HI was also calculated for each target organ/effect. If the cumulative corresponding HI for a target organ/effect was greater than 0.5, or the cumulative corresponding carcinogenic risk was greater than 5×10^{-5}, the anayltes contributing to these values were retained as COPCs and carried forward to Step 3.

Step 3

A corresponding risk level was again calculated as discussed above for Step 2. If more than five samples were available for that medium, the 95 percent upper confidence limit (UCL) was used in place of the maximum-detected concentration to calculate a corresponding risk level more representative of the site concentration. If the cumulative corresponding HI by target organ/effect was greater than 0.5, or the cumulative corresponding carcinogenic risk was greater than 5×10^{-5}, the constituents contributing to these values were considered COPCs.

ProUCL Version 4.1 (USEPA, 2010) was used to calculate the 95 percent UCLs used for the Step 3 risk ratio calculations.

5.2 Human Health Risk Screening Results

The human health risk-based screening (comparison to risk-based criteria and background levels, Step 1) and risk ratio evaluation (Steps 2 and 3, if applicable) were performed for the site sediment samples.

Appendix E Tables 2.1 through 2.1b present the risk-based screening and risk ratio evaluation for sediment. As shown in Table 2.1, seven PAHs [benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene] exceeded the Step 1 screening criteria and were identified as COPCs for further evaluation in Step 2. Two of these PAHs [benzo(k)fluoranthene, and chrysene] were selected as COPCs for further evaluation in Step 2 based on the selection criteria of a chemical from the same class, carcinogenic PAHs.

Step 2 (risk ratio using maximum-detected concentrations, Table 2.1a) resulted in all seven of the Step 1 COPCs being carried forward to Step 3. During Step 3 (risk ratio using 95 percent UCL concentrations, Table 2.1b) of the screening process, all COPCs were eliminated. Therefore, it is concluded that exposure to sediment at the Skeet Range would not pose any unacceptable human health risks.

5.3 Human Health Risk Screening Conclusion

Based on the evaluation of sediment data collected for the Skeet Range during the SI and ESI, the results of the human health risk-based screening indicate that there are no potentially unacceptable risks to human health. Since a sufficient number of samples were collected to characterize site conditions, and they were collected over a wide spatial distribution throughout the Skeet Range shotfall areas, no further evaluation of sediment for human health risks is warranted.

SECTION 6

Ecological Risk Screening

This section summarizes the ERS for the Skeet Range. The ERS was conducted to identify potential risks for aquatic biota in the Neuse River adjacent to Skeet Range. Tables associated with the ERS are included in **Appendix F.**

6.1 Earlier SI Ecological Risk Screening

During the SI, results for constituents detected in surface sediment (0-1 foot below sediment surface level), subsurface sediment (which included intervals collected at 1-2, 2-3, 3-4, 4-5 and 5-6 feet below sediment surface level), and surface water samples collected in May 2009 were screened against benchmarks intended to be protective of ecological receptors. Based on the results of that screening, no unacceptable risks were identified. However, additional surface sediment samples were collected in February 2012 during the ESI to better define the nature and extent of PAHs and to further refine potential human health risks identified during the SI.

6.2 ESI Ecological Screening

Even though no risks were identified via the ERS presented in the SI Report, additional screening was performed for ecological receptors since new sediment data became available when sampling was performed to further refine potential *human health* risks. As in the HHRS, sediment sample locations that may have been impacted by the Skeet Range activities (SD01, SD02, SD03, SD04, SD05, SD06, SD07, SD08, SD09, SD10, SD18, SD20, SD21, SD22, and SD23) were utilized for this ERS. The remaining background sample results were excluded.

For this ERS , newly-collected surface sediment data (2012) were evaluated along with the 2009 sediment data to determine if the additional PAH results would result in any changes to the conclusion of no unacceptable ecological risk from the ERS presented in the SI Report. Since no additional subsurface sediment or surface water samples were collected during the ESI, those media were not considered further.

The following screening process was used for the ERS (all tables are included in **Appendix F**):

- Site vs. Background Samples – Some 2009 and 2012 surface sediment samples were identified as background locations, while the rest were considered to be potentially site-impacted. The background samples are not expected to be influenced by the site or former site activities, and instead are believed to reflect the broader conditions of the Neuse River. A list of the eight background and 15 site-specific samples is provided as **Table E-1**. **Figure 3-1** shows the location of all site and background samples.
- Data Included in the ERS – Only the site-specific samples collected during the 2009 and 2012 investigations were included in this ERS. **Tables E-2** and **E-3** summarize all background and site-specific analytical results, respectively.
- Data Treatment – For the ERS presented in the SI, the maximum and mean concentrations of *individual* PAH compounds were screened against representative Ecological Screening Values (ESVs) intended to be protective of ecological receptors. HQs were calculated by dividing these concentrations by the ESVs. Because individual PAH compounds typically occur simultaneously in environmental media (e.g., sediment), and there are available ESVs for total PAHs (i.e., all PAHs have similar mode of action/impact), all sediment data were screened on a cumulative total concentration basis instead of on a compound-by-compound basis. Use of a total concentration more accurately represents the overall/cumulative potential for adverse effects associated with these compounds. Total PAH concentrations for a given sample were calculated as the sum of detected individual PAH compounds. For locations with a parent and field duplicate sample, the value of the greatest detected concentration was used. If the parent or duplicate yielded a detection for a given individual compound and the other was undetected, the detection was always used.
- ESVs – The USEPA Region 4 screening value for total PAHs in sediment is 1.684 mg/kg (USEPA, 2001). However, the threshold effect concentration (TEC; 1.61 mg/kg) from MacDonald et al. (2000) was used as the ESV since it reflects a consensus-based sediment quality guideline (SQG) for freshwater. Consensus SQGs

provide a unifying synthesis of other and existing SQGs that represent a broad spectrum of potential exposure impacts; therefore, there is greater confidence in their usefulness for screening sediment contaminants. As an SQG from McDonald et al. (2000), the TEC has a companion consensus-based probable effect concentration (PEC; 22.8 mg/kg) which can be used for screening purposes. Whereas the TEC represents a level below which adverse effects are not expected to occur, the PEC represents a level above which adverse effects are expected to occur more often than not. The TEC is analogous to a no observed adverse effect level (NOAEL) and is used for screening purposes in ERSs because of its conservative nature. However, based on the effects data and how the benchmarks are defined, the actual effect level (i.e., concentration posing impacts) is expected to occur at a concentration somewhere between the TEC and PEC values. Therefore both the TEC and PEC were considered for this ERS. It is also important to point out that the TEC is nearly identical to the Region 4 screening value.

- Screening – The HQ Method was used to estimate potential risks. By this method, the sediment concentrations are compared to the TEC and PEC (divided by) to derive risk estimates (HQs). HQs exceeding 1.0 suggest a potential for ecological risk, whereas HQs less than or equal to 1.0 indicate little potential for adverse effect and no need for further consideration.

6.3 Screening Results

The screening results for Skeet Range surface sediment samples are presented in **Table E-4**. The following bullets summarize these results:

- The total PAH concentrations of four of 15 samples (SD01, SD03, SD-18 and SD-20) exceed the TEC, with a maximum HQ of 4.8 (SD20);
- None of the sample-specific concentrations exceed the PEC;
- The average site-specific concentration of total PAHs does not exceed the TEC (HQ of 1.0);
- The average concentration of total PAHs in site samples is well below the PEC; and
- The total PAH concentrations in the samples that do not exceed the TEC are within the range of background total PAH concentrations (**Table E-2**).

6.4 Uncertainty

There are uncertainties for all risk assessments because of the limitations of the available data and the need to make certain assumptions and extrapolations based on incomplete information. The uncertainties in this ERS are primarily attributable to the following factors:

- Duplicate Analyses – For samples with duplicates, the value used in the ERS was always the detected concentration when a constituent was detected in one of the duplicate samples but not the other. In these cases, the use of the detected concentration has less uncertainty because it represents an actual measured value (versus an upper limit bound).
- Non-detects – Several compounds were not detected and were not included in the summed total PAH concentrations. Because the compounds were not detected, it is assumed they are not present in any of the sediment samples. There is some uncertainty associated with this assumption because there is no certainty these compounds are not present below the reporting limit, and there is some potential for risk to have been underestimated. However, standardized analytical methods were used and the sample reporting limits were not elevated relative to the method reporting limits. Therefore, eliminating the non-detected compounds from the total PAH concentration calculations is expected to have a minimal affect on the overall estimate of risk.
- Total PAHs – The assumption that impacts to receptors are better assessed on a cumulative basis (total PAHs) versus an individual PAH compound basis carries some uncertainty. This includes the possibility of underestimating individual compound impacts or possible synergistic/additive impacts of PAH compounds.

However, the use of SQGs accounts for a broad spectrum of documented effects from the scientific literature and represents contaminant mixtures in sediment. Additionally, PAHs are known to co-mingle in sediment and exhibit similar modes of action/impact. Therefore, screening individual compound concentrations is believed to carry more uncertainty than screening total concentrations. The uncertainty associated with the use of total concentrations is considered to be low.

6.5 Ecological Risk Summary and Conclusions

The screening results do not suggest a significant impact to receptor populations across the greater area of potential site influence (i.e., the shotfall zone). The evidence of this is apparent on a sample-specific and shotfall zone (habitat) wide basis. On a sample-specific basis, relatively few sample-specific total PAH concentrations exceed the TEC, while none exceed the PEC. On a habitat-wide basis, the mean total PAH concentration is equal to the TEC, but well below the PEC. Based on these screening results and comparison to background PAH concentrations, the ESI surface sediment results do not alter the conclusion from the SI that potential risks associated with PAHs in sediment at the site are generally low to negligible. It is concluded that additional investigation of sediment for the purposes of ecological screening is unwarranted.

SECTION 7

Release Assessment Conclusions and Proposed Future Action

This section presents the conclusions of the investigation results, HHRS, and ERS, and an evaluation of whether a CERCLA-regulated release has occurred at the Skeet Range that warrants further action.

7.1 Release Assessment Decision Analysis

The Skeet Range was operational from 1943 through approximately 1955. The shotfall area of the range was primarily within the Neuse River, a high energy, erosional environment. As a result, it is unlikely that clay targets or target fragments would remain in onsite sediment since the 1950s. Because it is heavier and more likely to resist transport from currents and wave action, lead shot has a higher potential to remain onsite than clay target fragments. However, neither lead shot nor clay target fragments were observed during surface and subsurface sediment sampling during the SI and ESI.

The primary release mechanisms associated with skeet and trap ranges, in general, include degradation of the lead shot and the varying levels of PAHs within the clay targets; a less significant potential release mechanism is propellant detonation from the firing of the shotguns at the firing points.

Soil

Four metals (aluminum, arsenic, cobalt, and iron) and three PAHs (benzo[a]pyrene, benzo[b]fluoranthene, and dibenz[a,h]anthracene) exceeded screening criteria in surface soil during the SI. These soil samples were collected behind the firing positions and not in the shotfall zones. Therefore, the detected PAHs in soil are not associated with clay targets from Skeet Range operations and can be attributed to non-site-related anthropogenic or natural sources. Perchlorate was not detected in any of the surface soil samples. Results of the HHRS and ERS did not identify unacceptable potential risks to human and ecological receptors from exposure to soil (CH2M HILL, 2010).

Sediment

In sediment, 10 PAHs were observed above ecological screening criteria, and 5 PAHs were above human health screening criteria in the combined 2009/2012 sediment data. Five metals (aluminum, arsenic, cobalt, iron, and manganese) exceeded screening criteria in the SI data. Since upstream sampling locations contained similar metals concentrations above screening criteria, metals detected at the Skeet Range were likely not a result of impacts from historical Skeet Range activities (CH2M HILL, 2010). It is important to note that lead (primary constituent of potential concern) was only detected at concentrations at or below background concentrations at the Skeet Range.

Although PAHs were observed above screening criteria in sediment within the shotfall area, these PAHs are not likely associated with range activities. One line of evidence supporting this assertion is that during the SI and ESI activities, it was observed that the Neuse River is a high energy environment, primarily due to wave action, and the shoreline in the vicinity of the site is erosional rather than depositional. As a result, lead shot, clay targets, and clay target fragments originating in the 1940s to mid-1950s are more likely to have been transported away from the Skeet Range during the past 6 decades than deposited in site sediments. The lack of observed lead shot and clay target fragments in site surface and subsurface sediments to a depth of 6 feet and lead concentrations at or below background concentrations supports this conclusion.

Additionally, it is well documented that PAHs are ubiquitous in urban environments and are contributed to watersheds via stormwater runoff and atmospheric deposition from a myriad of sources, including the combustion of fossil fuels (e.g., exhaust from automobiles and airplanes and from power plant emissions), abraded tire particles and debris on roadways, asphalt pavement constituents, coal-tar and asphalt-based sealcoats, roofing tar, and used motor oil (ATSDR, 1995; Yang et al., 2010). Indeed, PAHs were also observed in sediment samples collected upstream of the Skeet Range, including one sample location at concentrations above

screening criteria (SD18). As discussed in the WCSD (**Appendix A**), numerous other potential PAH sources were identified within the Neuse River watershed upstream of the site that may explain the concentrations detected within the Skeet Range. The Skeet Range is located almost immediately downstream of where Slocum Creek enters the Neuse River. Slocum Creek receives considerable stormwater runoff from roadways and paved surfaces within the Air Station and from major roads and parking lots in the town of Havelock. The Neuse River receives countless urban stormwater discharges upstream of the Skeet Range as indicated by the results of the 1998/1999 NOAA study that identified benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene upstream of the Skeet Range in Neuse River sediments. The compounds identified in the NOAA study that exceeded RSLs at various locations along the Neuse River upstream of the Skeet Range are the same PAHs exceeding screening criteria in the Skeet Range samples.

In addition, ESI samples collected immediately adjacent to samples with elevated PAH concentrations collected during the SI (except at SD04) did not contain PAHs or had concentrations below screening criteria, indicating that elevated PAH results are localized and sporadic. Laterally, the sediment samples with relatively high concentrations of PAHs seemed to be correlated to near-shore sampling locations in general rather than the extent of the shotfall zones in the Skeet Range. Vertically, PAHs exceeded screening criteria in only one subsurface sediment sample (2 to 3 ft depth interval at SD09), but did not exceed criteria in any other subsurface sample interval to a depth of 6 ft (CH2M HILL, 2010).

Regardless of whether or not PAH concentrations detected within the Skeet Range are site-related, both the HHRS and ERS performed as part of the ESI concluded that there were no unacceptable potential risks to human and ecological receptors from exposure to sediment at the Skeet Range.

Surface Water

Four PAHs (benzo[b]fluoranthene, benzo[k]fluoranthene, dibenz[a,h]anthracene, and indeno[1,2,3-cd]pyrene) and one metal (manganese) exceeded screening criteria in surface water samples collected during the SI (CH2M HILL, 2010). All PAH exceedances were detected within and downstream of the theoretical shotfall zone. Total PAHs exceeded the NC 2B regulatory standard (0.0311 μg/L) with a maximum concentration of 2.75 μg/L downstream of the shotfall zone. However, as discussed above in the sediment subsection, PAH concentrations near the shotfall zone are likely not associated with range activities.

Metals were detected in an upstream background sample at similar concentrations to those detected within and downstream of the shotfall zone. The presence of elevated metals concentrations in the upstream background sample indicates that metals impacts are not likely attributable to historical Skeet Range activities.

The HHRS and ERS conducted as part of the SI concluded that there were no unacceptable potential risks to human and ecological receptors from exposure to surface water at the Skeet Range (CH2M HILL, 2010).

7.2 Proposed Future Action

The 2009 SI and 2012 ESI at the Skeet Range were conducted to evaluate the presence of PAHs in soil, sediment, and surface water to determine whether a CERCLA-regulated release had occurred, and to evaluate risk to human and ecological receptors from exposure to these media. Based on the release assessment decision analysis, the presence of PAHs at the site is not likely associated with Skeet Range activities. In addition, the HHRS and ERS concluded that there were no unacceptable potential risks to human health and ecological receptors from exposure to environmental media at the Skeet Range. As a result, no further investigation is warranted at the Former Skeet and Trap Range #1 and it is recommended that a path forward of no further action be documented in a No Action Decision Document.

SECTION 8

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Appendix A
Watershed Contaminated Source Document

Final

Watershed Contaminated Source Document for Skeet and Trap Range #1

Marine Corps Air Station Cherry Point
Cherry Point, North Carolina

Contract Task Order 0026 Modification 2

November 15, 2012

Prepared for

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Acronyms and Abbreviations

ATSDR	Agency for Toxic Substances and Disease Registry
CAMA	Coastal Area Management Act
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CNO	Chief of Naval Operations
CSM	conceptual site model
EDR	Environmental Data Resources, Inc.
ERNS	Emergency Response Notification System
HAP	hazardous air pollutant
HHRA	human health risk assessment
HMIRS	Hazardous Materials Incident Report System
IAS	Initial Assessment Study
IMD	Incident Management Database
IRP	Installation Restoration Program
LAST	leaking aboveground storage tank
LUST	leaking underground storage tank
MCAS	Marine Corps Air Station
MGD	million gallons per day
µg/kg	micrograms per kilogram
NCDENR	North Carolina Department of Environment and Natural Resources
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
OU	Operable Unit
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
RCRA	Resource Conservation and Recovery Act
RI	remedial investigation
RSL	regional screening level
SLERA	screening-level ecological risk assessment
SI	Site Inspection
SWMU	solid waste management unit
SWPPP	storm water pollution prevention plan
USACE	United States Army Corps of Engineers
USDA	United States Department of Agriculture
USGS	United States Geological Survey
USEPA	United States Environmental Protection Agency
UST	underground storage tank
VOC	volatile organic compound
WCSD	Watershed Contaminated Source Document

SECTION 1

Introduction

This Watershed Contaminated Source Document (WCSD) identifies potential sources of contamination in the Neuse River watershed (**Figure 1**) in the vicinity of Marine Corps Air Station (MCAS) Cherry Point in Cherry Point, North Carolina (**Figure 2)**. Specifically, this document evaluates potential sources of polycyclic aromatic hydrocarbons (PAHs) in Neuse River sediments at the Former Skeet and Trap Range #1 (referred to hereafter as the Skeet Range) at MCAS Cherry Point. The study area includes the portions of the Neuse River watershed shown on **Figure 3**.

1.1 Purpose

As described in the Navy's *Policy on Sediment Site Investigation and Response Action* (Chief of Naval Operations [CNO], 2002), a WCSD is a brief summary report that qualitatively evaluates the potential for both Navy and non-Navy sources to have contaminated sediments in water bodies that are located adjacent to Navy property. If there is potential for sediments in a water body to be impacted by chemicals originating from both Navy and non-Navy sources, then the Navy requires preparation of a WCSD. The WCSD identifies and qualitatively evaluates potential contaminant sources and known releases from different sources (both Navy and non-Navy) to a water body, as well as transport mechanisms, exposure routes, and receptors.

The main purposes of the WCSD are to assist in determining the Navy's cleanup responsibility, if any, in an off-site water body and/or to assist in evaluating the potential that a site that may be remediated by the Navy on or near the water body will become re-contaminated from other source areas after the remedial action is completed. Thus, the WCSD attempts to document, using existing information, possible sources of contamination to a water body determined to be, or likely to be, contaminated. This information can be used in the Navy's decision-making process to help determine the appropriate course of action for the water body.

The Navy has produced a fact sheet (CNO, 2003) that explains when a WCSD is necessary, the contents of a WCSD, how the WCSD is used to determine the Navy's cleanup responsibility in a water body, and how a WCSD is used to evaluate the potential for Navy-remediated sediments to become re-contaminated following a cleanup action. The fact sheet states that the WCSD is intended to be a brief summary report and not a watershed investigation, nor a document intended to identify potentially responsible parties, degree of responsibility, or any legal determinations.

1.2 Skeet Range WCSD Approach

PAHs are some of the most widespread organic pollutants. PAHs are a group of over 100 different chemicals that are produced in exhaust from gasoline and diesel engines and other vehicles, emissions from the burning of coal and oil, incinerators, asphalt processing and use, and industrial emissions (USEPA, 2012). PAHs can be manufactured and found in coal tar, crude oil, and creosote. PAHS are also present in organic substances like pine and tobacco (ATSDR, 2011).

PAHs are relatively stable in the atmosphere and are capable of long distance transport. Air-borne PAHs bound to particulate matter may be transported through the air and deposited on land or surface water. PAHs are expected to adsorb strongly to soil, sediments, and particulate matter. Adsorption in sediment may retard degradation of PAHs over time (USEPA, 2012). PAHs bound to soil and sediment have little mobility and persist in the environment (USEPA, 2000).

The 2009 Skeet Range Site Inspection (SI) identified PAH concentrations in sediment exceeding human health risk screening criteria. These PAHs included benzo[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, dibenz[a,h]anthracene, and indeno[1,2,3-cd]pyrene. Based on detections of several PAHs at the site, the SI Report (CH2M HILL, 2010) recommended the evaluation of potential sources of PAHs in sediment. Since there is

also the potential for non-Navy and non-site-related sources to contribute PAHs to site sediment, a WCSD was performed for this site in accordance with Navy guidance.

1.3 WCSD Geographic Scope

The geographic scope of this WCSD includes a study area that encompasses portions of the Neuse River watershed upstream of and in the immediate vicinity of the Skeet Range. This study area includes portions of the Neuse River, Slocum Creek, the City of Havelock, MCAS Cherry Point, and surrounding areas (**Figure 3**). This study area was defined for the purposes of this WCSD based on Neuse River tributary watershed areas delineated by the State of North Carolina that drain to the Neuse River in the vicinity of the Skeet Range. The WCSD focuses on specific potential PAH sources within the immediate vicinity of the site. The Neuse River watershed is significantly larger than the study area and is expected to contain numerous other potential PAH sources at greater distances from the site; however, a detailed evaluation of these additional potential sources is beyond the focus of this study. A general discussion of the potential PAH sources located outside the study area boundary is included in this document as there is potential for PAHs originating outside the study area boundary to migrate to and impact the Skeet Range site.

1.4 Study Area Description

1.4.1 Study Area Location

The study area is approximately 87 square-miles in size. The study area encompasses portions of the City of Havelock and MCAS Cherry Point (**Figure 3**), and was delineated for the purposes of this WCSD based on the location of the Skeet Range in relation to watershed areas of major Neuse River tributaries delineated by the State of North Carolina that drain to the Neuse River.

1.4.2 Physical Characteristics

1.4.2.1. Neuse River Basin

The Neuse River Basin has a drainage area of 6,235 square miles and contains a population of nearly 1.7 million people (**Figure 1**). The entirety or major portions of 18 counties are located within the river basin. The basin extends from northwest of Durham, North Carolina to Pamlico Sound to the southeast, and contains large population areas including Raleigh, Durham, Goldsboro, Kinston, and New Bern. The Neuse River Basin is split into major watersheds, with the study area being located in the Lower Neuse Watershed (NCDENR, 2010).

1.4.2.2. Craven County

The surface water within the study area drains directly to the Neuse River or to Slocum Creek and its tributaries, which ultimately drain into the Neuse River. The waters in this study area are part of the Neuse River Basin and are estuarine in nature. Because of the proximity to the barrier islands of the North Carolina Outer Banks, water exchange with the Atlantic Ocean is slowed, resulting in minimal discharge and long hydraulic residence times within the estuary (NCDENR, 2009). Groundwater is generally located near the surface within the study area.

1.4.2.3. MCAS Cherry Point

MCAS Cherry Point is located in the Neuse River Basin and contains approximately 1,600 acres of wetlands. MCAS Cherry Point is bounded to the north and east by the Neuse River and Hancock Creek, respectively. Slocum Creek is located in the western portion of MCAS Cherry Point. The small tributaries of the larger creeks are supplied by groundwater and stream flow is intermittent. The Neuse River, Slocum Creek, Hancock Creek, and their larger tributaries are tidally influenced and affected by wind action. Surface water runoff flows to Slocum Creek or its tributaries, such as Turkey Gut and Schoolhouse Creek, which ultimately drain into the Neuse River (USEPA, 2011).

1.4.3 Land Use

The study area includes Navy (MCAS Cherry Point) and non-Navy properties of residential, commercial, and industrial use. Moderate residential growth is occurring in the study area with the City of Havelock population

increasing by 24.9 percent (5,748) within the past 10 years (NCDENR, 2009). Land use within the study area also includes forest land, agricultural, and recreational (**Figure 4**).

1.4.3.1. Navy Property

The Navy property consists of approximately 20 percent of the land use within the study area. MCAS Cherry Point encompasses more than 11,000 acres in Craven County with land use consisting of office buildings, aircraft maintenance facilities, utilities, an airfield, housing units, child schooling facilities, eateries, recreational facilities, and marinas located in the vicinity of Slocum Creek and Hancock Creek.

1.4.3.2. Non-Navy Property

Non-Navy property consists of approximately 80 percent of the land use within the study area, with the most common land use activity associated with residential, agricultural, and office and institutional land use (**Figure 4**).

The residential land is dispersed throughout the study area. Because there is no County-wide zoning ordinance, many residential areas are intermixed with non-residential land uses. The agricultural land use category includes large tracts of land that are used for farming and/or farm related activities, including some low-density residential use. The office and institutional land use category includes properties designated as governmental facilities, churches, office parks, and organizational facilities. Office/institutional facilities are located throughout the County. Commercial land use equates to businesses. Commercial land is dispersed throughout the study area, primarily along highways and crossroads.

SECTION 2

WCSD Methods

The following subsections summarize the methods used to prepare the WCSD and identify the data sources consulted. The primary methods used were literature and Internet searches, agency and organization contacts, and the compilation of facility-specific information from Navy sources and contacts. A reconnaissance survey of the investigation area was also conducted to confirm land use and to verify the presence of sites and features identified during literature searches and interviews.

2.1 Literature and Internet Searches

The study area encompasses portions of the Neuse River, Slocum Creek, the City of Havelock, MCAS Cherry Point, and surrounding areas (**Figure 3**). Literature and Internet searches were performed to gather information on the area's environmental setting and land use activities to evaluate potential Navy and non-Navy source areas within the study area.

The government agencies and private organizations that were contacted for relevant information, or whose web sites were researched, included:

- Agency for Toxic Substances and Disease Registry (ATSDR) – The Public Health Assessments and Health Consultants published a 2010 Public Health Assessment for MCAS Cherry Point. The assessment lists the Installation Restoration Program (IRP) sites at MCAS Cherry Point with the associated waste disposal history, stage of investigation, and ATSDR evaluation determination (ATSDR, 2010).
- City of Havelock – The Planning and Inspections Department in conjunction with the Information Technology Department provided mapping data for land use area, drainage, utility, and outfall locations. The City of Havelock also published the 2010 City of Havelock Waste Water System Performance Report (City of Havelock, 2010).
- Craven County – The Craven County Coastal Area Management Act Core Land Use Plan (Holland Consulting Partners, Inc., 2009) provided digital land use data for Craven County.
- Environmental Data Resources, Inc. (EDR) - This private organization provided information on sites listed under various regulatory programs (for example, Resource Conservation and Recovery Act [RCRA], Comprehensive Environmental Response, Compensation, and Liability Act [CERCLA], Underground Storage Tank [UST]) and reported releases on Navy and non-Navy properties within the study area (EDR, 2011). The EDR report was obtained for environmental sites located within a 5-mile radius centered on MCAS Cherry Point.
- National Oceanic and Atmospheric Administration (NOAA) –This federal agency provided study research and analytical results for sampling projects focused on assessing sediment quality and the condition of benthic fauna in the Neuse River Estuary, North Carolina.
- North Carolina Department of Environment and Natural Resources (NCDENR) –
  - The Division of Air Quality provided locations of air monitoring stations across North Carolina as well as the types of industries that currently have air permits.
  - The Division of Waste Management provided National Pollutant Discharge Elimination System (NPDES) permit information.
  - The Division of Water Quality provided NPDES permit information and the Neuse-River Basin-Wide Water Quality Plan.
  - The Division of Water Resources Divisions provided the Craven County Water Quality Report for 2010.

- U.S. Environmental Protection Agency (USEPA) – The Permit Compliance System provided information on NPDES permit holders within the study area.
- U.S. Geological Survey (USGS) - The USGS provided digital land cover data that were used to determine land use areas within the study area.
- U.S. Navy – The Environmental Affairs Department at MCAS Cherry Point provided information on permits, historical documents, sampling data, RCRA Solid Waste Management Unit (SWMU) locations, UST Remedial Sites, and the Storm Water Pollution Prevention Plan (SWPPP) for MCAS Cherry Point. The Facilities Division provided information on construction activities on MCAS Cherry Point.

MCAS Cherry Point personnel were contacted for facility-specific information, which included:

- Environmental Setting - MCAS Cherry Point provided documentation on facility boundaries and physical characteristics, as well as information on topography, hydrology, geology, and hydrogeology for the area.
- Outfall Information - The MCAS Cherry Point NPDES permits and SWPPP provided permitted outfall locations, receiving water bodies, historical releases to surface water, and associated buildings and/or activities.
- Listed Sites – MCAS Cherry Point provided the information used to determine the location and identification of Navy IRP Sites, SWMUs, USTs, spill areas, and chemical/hazardous material storage sites.

2.2 Reconnaissance Survey

A reconnaissance survey of the study area was conducted between June 6 and 9, 2011, to confirm land use, to verify the presence of listed sites identified during the literature and Internet search, and to interview MCAS Cherry Point personnel regarding historical and current Navy activities.

SECTION 3

WCSD Results

This section provides a description of the area studied and compiles, summarizes, and qualitatively evaluates the available data from Navy and non-Navy sources.

3.1 Potential Contaminant Sources to the Study Area

This section identifies potential sources that may contribute contaminants to the Neuse River. A portion of chemicals entering the Neuse River are likely to result from oil, grease, and toxic chemicals from urban runoff and energy production.

Greater concentrations of PAHs in urban soils have been observed as the environment is more exposed to the PAHs produced by stationary sources such as industrial activities, mobile sources like traffic emissions (gas and diesel-powered vehicles), and road byproducts including tire wear and asphalt constituents. In a study of PAHs in typical urban use soils of different land uses, results showed PAHs in urban soils to be two orders of magnitude greater than the background levels of PAHs in soils, indicating that anthropogenic sources are the major contributors of PAHs (Banger et al., 2010).

Potential sources of contamination to Slocum Creek that are not related to MCAS Cherry Point were investigated by Tetra Tech EM, Inc. The study concluded that the largest non-Navy source of chemicals (including PAHs) to Slocum Creek is non-point source runoff from residential and commercial areas of Havelock. Additionally, the survey indicated that businesses located near the headwaters of Slocum Creek might be minor contributors of chemicals to Slocum Creek (Tetra Tech NUS, Inc., 2001). PAHs are likely constituents of non-point source runoff from both residential and commercial activities.

3.1.1 Transportation

A significant source of PAH emissions is from motor vehicle wear and engine combustion processes. PAHs are often associated with combustion processes (Marr et al., 1999) such as those from various types of engines, including automobiles, trucks, aircraft, and boats.

Major roadways, such as Highway 70, are present within the study area. Gasoline and diesel-powered automobiles traveling within the study area potentially release PAHs through numerous pathways including the combustion of fossil fuels, tire wear, and the breakdown of asphalt constituents. PAHs bound to particulate matter are transported through the air and may be deposited on land, and transported via runoff to surface water bodies.

Runoff from the MCAS Cherry Point flight line discharges directly to several of the storm water outfalls. Oil water separators at locations throughout the Air Station were installed to control storm water outfall discharges between 1980 and 2005 (Harrison, 2012). However, discharges and runoff from the flight line were previously uncontrolled. Additionally, the runways at MCAS Cherry Point are located within close proximity to the Neuse River. Spills or releases resulting from emergency situations could potentially discharge to the Neuse River or its tributaries. For example, an emergency aircraft landing in October 2002 resulted in 600 gallons of JP-5 (which contains PAH constituents) being spilled into the Neuse River (AH Environmental Consultants, 2006 and ATSDR, 1998).

The Neuse River is transited by commercial and private vessels for fishing operations, recreational purposes, and material transport. During transit, vessels likely produce PAHs as combustion byproducts. Additionally, leaks and spills from poorly maintained vessels could be a potential source of PAHs. Illegal discharges from commercial and private vessels also could potentially contribute PAHs to the study area.

Two marinas are located within the bounds of MCAS Cherry Point; one is located on Slocum Creek, and the second is located on Hancock Creek. Both marinas are used for recreational purposes. There are several marinas located on the Neuse River; however, they are outside of this watershed study area. Typical activities at the public

marinas include high-pressure washing and engine repair, which have the potential to contribute PAHs to the environment.

3.1.2 Coal-Tar-Based Sealant

Studies conducted by the USGS (2011) recognize that coal-tar-based sealant is a major source of PAH contamination in urban areas in the United States. This sealcoat is a black liquid that is painted or sprayed onto asphalt pavement. It is commonly applied to parking areas associated with commercial businesses, apartment complexes, churches, and schools (USGS, 2011).

During the June 2011 reconnaissance survey, the use of coal-tar-based sealcoat was observed in parking areas for commercial, retail, fast food restaurants, hotels, and schools within the study area boundary. Historically, coal-tar-based sealant has been applied on pavement throughout MCAS Cherry Point. Based on site reconnaissance observations, this sealant is no longer used on the majority of the Base roadways. However, use of this sealant was observed in one commercial parking lot located on-base. Additionally, a coal-tar-based sealant has been and is currently used on the runway hardstand areas within the MCAS Cherry Point flightline (Miller, 2011).

Studies found that dust from pavement with this sealant has greatly elevated PAH concentrations compared to dust from unsealed pavement. PAHs are transported from the sealant surface into the environment by storm water runoff, attachment to tires, wind, foot traffic, and volatilization. A USGS study indicated that coal-tar-based sealant accounted for one-half of all PAHs in urban lakes on average, and vehicle-related sources accounted for about one-fourth of all PAHs in study areas throughout the United States (Mahler and Van Metre, 2010).

The presence of coal-tar-bases sealant on both Navy and non-Navy property is a potential PAH source for Slocum Creek and the Neuse River.

3.1.3 Environmental Sources

PAHs have the ability to accumulate in vegetation. In studies, such as the one conducted by Wagrowski and Hites in 1996, pine trees were used to estimate PAH accumulation rates. Eroding shorelines are common in Craven County, occurring along the Neuse River southern shoreline, east of the Trent River. According to the United States Department of Agriculture (USDA) Natural Resource Conservation Service, the Neuse River annual erosion rate has been approximately three and a half to four feet per year (Holland Consulting Planners, Inc., 2009). The erosional environment could expose roots of vegetation on the banks of Slocum Creek and the Neuse river, increasing the amount of decomposing vegetation (and potential PAHs) entering the study area.

The Croatan National Forest is located within the southern portion of the study area, is largely dominated by pine trees, and covers 11% of the study area. Additionally, pine is the dominant canopy tree at MCAS Cherry Point (Brown & Root Environmental, 1996). Kim et al. (2003) verified that PAHs may be released during forest fires and redistributed on the ground (Kim et al., 2003). Eastern North Carolina has frequent forest fires, such as the “Evans Road Wildfire” in 2008, which burned over 40,000 acres in the Pocosin Lakes National Wildlife Refuge, located less than 80 miles north of MCAS Cherry Point. In 1985, 95,000 acres burned in the Pocosin Lakes National Wildlife Refuge reducing surface elevations by as much as three feet due to the combustion of peat (U.S. Fish & Wildlife Service, 2011).

3.1.4 Illicit Discharges into Waterways

Illicit dumping contributes to storm water pollution. An illegal discharge is any disposal into the storm drain system for which a person or business does not have a permit. Improper disposal of used motor oil is an example of a prohibited discharge which might contribute to PAH contamination in the study area. Because not all illicit discharges can be observed or recorded, the impact of these activities cannot be clearly defined or quantified.

3.1.5 Other Water Bodies

Neuse River sediment may also be impacted by discharges to surface water outside the study area. As detailed in Section 3.3, PAHs have been detected at concentrations exceeding RSLs within the Neuse River upstream of the study area. The City of New Bern is a sizeable urban area located on the Neuse River approximately 15 miles

upstream of the Skeet Range. As discussed in previous sections, the transport pathways of PAHs into the Neuse River and other tributaries include deposition of particulate matter generated during incomplete combustion, NPDES and storm water discharges, surface transportation runoff, potential releases from marine vessels, runoff from coal-tar-based sealant, and other environmental sources. Due to the persistence of PAHs in the environment, PAH impacts observed in Skeet Range sediments may have originated outside the study area, and there is potential for future PAH impacts from outside the study area to impact the site.

3.2 Listed Sites

Listed sites are point sources that can contribute to the contamination of the Neuse River's sediments. For this WCSD, listed sites are defined as sites with recorded releases or sites that have the potential to release PAHs into the environment as defined by federal and state regulatory programs (CERCLA, RCRA, UST programs) or listed in federal or state databases (Hazardous Materials Incident Report System [HMIRS], Incident Management Database [IMD], leaking underground storage tank [LUST]). The following subsections summarize the known listed sites on Navy and non-Navy property, which are shown on **Figure 5**.

3.2.1 Navy Property

The types of listed sites at MCAS Cherry Point within the study area have been divided into three categories. The number of sites and specific sites per category are shown in **Table 2** and displayed on **Figure 5**. The categories are defined below:

- CERCLA - Sites included in the IRP of which potential releases may be associated with spillage or leaching of PAHs
- RCRA – Sites that generate, store, treat, or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act
- UST – Sites where underground storage tanks are located; potential releases may result from spills or leaks in the tanks or piping systems

The investigations conducted at these sites indicated that there have been no releases of PAHs that have impacted Slocum Creek or the Neuse River.

3.2.2 Non-Navy Property

A search of environmental records from federal, state, and the EDR proprietary historical databases was conducted to locate and identify listed non-Navy sites with the potential for current or historical PAH discharges to the environment. **Table 3** shows the types of non-Navy listed sites that were found and the number of sites in each category (EDR, 2011).

The most common types of non-Navy listed sites within the study area are categorized under the UST (registered underground storage tanks) database and Leaks and Spills under the Leaking Aboveground Storage Tanks (LAST), LUST (leaking underground storage tanks), IMD, Emergency Response Notification System (ERNS), and HMIRS databases. Petroleum products, such as diesel, heating/fuel oil, and kerosene, were the main source of potential PAH contamination at these listed sites (**Table 3**). Fuel and other petroleum hydrocarbon storage are found at marinas, retail stores, and service stations. USTs and other types of fuel oil storage have the potential to contribute contamination of PAHs to the study area as PAHs are present in these petroleum products and may be released to the environment through surface or subsurface releases (Holland Consulting Planners, Inc, 2009).

3.3 Environmental Investigations

3.3.1 Previous MCAS Cherry Point Investigation Results

Several investigations of MCAS Cherry Point CERCLA sites have included the collection of sediment and surface water samples in Slocum Creek and its tributaries. These investigations were performed to evaluate whether the

sites have impacted nearby water bodies. Human health and ecological risk evaluations concluded that no unacceptable risks to human health or the environment result from PAH concentrations in sediment and surface water samples collected from Slocum Creek (Brown & Root Environmental, 1996a; Brown & Root 1996b; Naval Facilities Engineering Command, 2003; and Tetra Tech NUS, 2001).

3.3.2 NOAA Investigation – July 1998 and November 1999

Neuse River sediment samples were collected by NOAA at 20 locations extending from the mouth of the Neuse River at Pamlico Sound to approximately 90 km upstream in July 1998 and November 1999 to assess the impacts of hurricanes on sediment and benthic fauna (Balthis et al, 2006 and Balthis et al, 2002). The NOAA sediment sampling locations are shown on **Figure A-1**. Eleven of the 20 sample locations (01 through 11) are upstream of the Skeet Range and the remaining 9 locations (12 through 20) are located downstream of the Skeet Range. The sediment samples collected throughout the study area were analyzed for PAHs in addition to other parameters. The PAH analytical data from this study are presented in **Attachment A.**

Comparing the NOAA sediment data to current adjusted USEPA Regional Screening Levels (RSLs) for residential soil, five PAHs exceeded one or more RSLs in at least one sample: benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene. To determine the adjusted RSLs, RSLs based on non-cancer endpoints are divided by ten to adjust to a hazard quotient of 10 to account for exposure to multiple constituents that affect the same target organ. RSLs based on cancer endpoints are not adjusted. These are the identical PAHs that exceeded the same screening criteria in multiple sediment samples collected from the Neuse River during the 2009 Site Inspection and 2012 Expanded Site Inspection. One or more of these PAHs were detected in 6 of the 11 NOAA sample locations upstream of the Skeet Range and 3 of the 9 locations downstream of the Skeet Range. Of the upstream sample locations, one or more RSLs for these 5 PAHs were exceeded at 4 of the 11 locations (02, 07, 10, and 11); for the downstream locations, samples at only one location (17) contained PAH exceedances.

3.4 Air Quality

There are no NCDENR Division of Air Quality monitoring stations within the study area or within Craven County. Therefore, there are no air-monitoring stations that are representative of the study area.

As of April 2011, there were three facilities within the study area with active air permits, one being MCAS Cherry Point. MCAS Cherry Point currently holds a Title V air permit which applies to “major sources.” Examples of sources included in the permit are the Air Station power plant, generators, storage tanks, fuel dispensing facilities, parts-cleaning facilities, and spray booths. There are no PAH limits established in the Title V air permit.

The two remaining facilities within the watershed study area with active air permits include a municipal wastewater treatment plant and a concrete company. These facilities hold small minor air permits, and PAH compounds are not monitored at either facility.

Although equipment used at these sites may generate PAHs through incomplete combustion, PAHs are not monitored at these permitted facilities.

3.5 Outfalls

Under the NPDES, all facilities which discharge into waters of the United States are required to obtain a permit. This program controls water pollution by regulating point sources that discharge pollutants into waters of the United States. NPDES regulates three types of activities: industrial activities, municipal separate storm sewer systems (MS4s), and construction activities that disturb an acre or more. Most storm water discharges are considered point source and operators responsible for these sources may be required to hold a NPDES permit before discharge is allowed. Point sources are conveyances such as pipes or man-made ditches.

3.5.1 Navy Property

MCAS Cherry Point has developed and maintains a SWPPP which is used to manage and monitor storm water discharges from MCAS Cherry Point and outlying fields. Storm water discharges across MCAS Cherry Point are directed to adjacent surface water bodies by a series of storm sewers, drainage ditches, and tributaries (AH Environmental Consultants, 2006). The SWPPP identifies potential pollutant sources that may be expected to contribute to the contamination of storm water discharges. PAHs may be released to the environment and enter the storm water system due to runoff from industrial activities such as vehicle and aircraft maintenance, washdown and fueling areas, outdoor material storage, fire fighting training, jet engine testing, waste disposal areas, and roadways and parking lots. These potential sources utilize materials containing PAHs, generate PAHs through incomplete combustion, or may release PAHs due to the breakdown of materials such as tire breakdown fragments, oil, asphalt constituents, and sealcoat particulates.

MCAS Cherry Point currently holds a storm water discharge permit, NPDES permit NCS000314, which expires on March 31, 2016. This permit authorizes the discharge of storm water and the operation of oil-water separators associated with some of the storm water outfalls to the Neuse River, Slocum Creek, and Hancock Creek. The storm water discharge is subject to monitoring requirements and discharge limits. PAHs are not monitored at the outfall locations, as PAHs have not been identified as posing a significant potential impact to receiving water bodies.

MCAS Cherry Point also holds a facility discharge permit, NPDES permit NC0003816, which expires on June 30, 2013. This permit authorizes the operation of a 6.5 million gallons per day (MGD) (design estimate) wastewater treatment facility and discharge at the outfall location shown on **Figure 5** (NCDENR, 2004). The MCAS wastewater treatment facility treats wastewater produced from the industrial processes at the Air Station. PAHs are not monitored at the outfall locations, as PAHs have not been identified as posing a significant potential impact to receiving water bodies.

Table 1 lists the permitted outfalls at MCAS Cherry Point with associated activity and receiving water body. **Figure 5** presents the location of permitted outfalls within the MCAS Cherry Point property boundary.

While storm water and industrial wastewater discharges are currently permitted under the NPDES program, historical wastewater discharges at MCAS Cherry Point were not permitted and did not undergo the same level of treatment as they presently do. According to the Initial Assessment Study (IAS) (Water and Air Resources, 1983), a common practice for disposal of industrial wastes in the 1940s and 1950s was to dispose of the waste in nearby ditches or to wash the waste into floor drains which discharged directly to tributaries of Slocum Creek. Additionally, until about 1960, used engine oil, which may contain elevated levels of PAHs, was sprayed on dirt roads at the Air Station to keep down the dust.

3.5.2 Non-Navy Property

There are three facility permit discharge permits on non-Navy Property within the study area. These facilities include various wastewater treatment plants (**Table 1**). Each of these permitted outfalls discharges directly into a tributary of the Neuse River. **Table 1** lists the three NPDES permitted outfalls with associated activity and receiving water body. **Figure 5** presents the location of the permitted outfalls located outside of the MCAS Cherry Point property boundary. PAHs are not monitored at the outfall locations, as PAHs have not been identified as posing a significant potential impact to receiving water bodies.

Potential sources of chemicals discharged to Slocum Creek that are not related to MCAS Cherry Point were investigated by Tetra Tech EM, Inc. in 1998. During a ground survey and interviews, anecdotal information was obtained which indicated the possibility of a defunct metal plating company that may have discharged to Slocum Creek through a wastewater treatment plant outfall, located in the East Prong of Slocum Creek. PAHs have been found to be associated with metal plating operations. The plating company's existence could not be verified (Tetra Tech NUS, Inc., 2001).

In addition to the permitted sources, there are likely numerous unpermitted potential storm water outfalls, such as storm water drainage pipes and ditches that are present throughout the study area that could contribute PAHs

to Slocum Creek and the Neuse River. These unpermitted outfalls may contribute PAHs to the study area from industrial activities, waste disposal areas, roadways and parking lots. These potential sources utilize materials containing PAHs, generate PAHs through incomplete combustion, or may release PAHs due to the breakdown of materials such as tires, oil, asphalt constituents and sealcoat particulates, as discussed further in Section 3.8.

3.6 Conceptual Site Model

The compiled information in the previous sections was used to develop a preliminary conceptual site model (CSM) for the Neuse River that identifies potential sources and releases (both Navy and non-Navy) as well as possible transport mechanisms, exposure routes, and receptors (**Figure 6**). The following subsections describe the major components of the preliminary CSM.

3.6.1 Potential Source Areas and Releases

Potential sources of PAHs within the study area include upstream and downstream surface water bodies, industrial sources, urban sources, and environmental sources (**Figure 6**).

3.6.2 Transport Pathways

Transport pathways describe the mechanisms whereby chemicals may be transported from a source of contamination to an exposure medium, such as sediment, where human and/or ecological exposures can occur. These transport pathways are shown on **Figure 6**. Contaminant transport mechanisms include:

- Surface water/sediment transport
- Wastewater outfalls
- Deposition of particulates
- Surface runoff
- Leaching/desorption to subsurface and groundwater
- Groundwater discharge
- Decomposition of vegetation

Contaminants transported into the Neuse River can affect both surface water and sediment in the river. Contaminants in the river sediment and surface water may also accumulate in the tissues of aquatic biota, and are thus transported to upper trophic-level receptors, including both human and ecological receptors, via food webs.

SECTION 4

Conclusions and Recommendations

During site inspection activities at the Skeet Range, PAH constituents were detected in Neuse River sediments at concentrations exceeding risk-screening criteria. This WCSD was prepared to identify Navy and non-Navy PAH sources that may have impacted sediment in the vicinity of the Skeet Range. The WCSD encompasses the Neuse River watershed upstream of and in the immediate vicinity of the Skeet Range including portions of the Neuse River, Slocum Creek, the City of Havelock, MCAS Cherry Point and surrounding areas (**Figure 3).**

There are a number of potential PAH sources of contamination to the Neuse River within the study area, including outfalls (storm water and facility discharges), transportation activities, coal-tar sealant used on pavement, and naturally-occurring environmental sources. PAHs may be transported into the Neuse River through numerous potential pathways and may be present in sediment or surface water. Surface water runoff and water from adjacent water bodies may directly discharge contaminants into the river. Contaminants may reach the river from surface and subsurface soils through leaching to groundwater or directly through overland flow and the storm water system. Contaminants transported through air can be directly deposited into the river or deposited onto the surrounding surface soil and eventually into the river through surface runoff or groundwater. Contaminants in the surface water or sediments of the Neuse River may then accumulate in the tissues of aquatic biota and then be transported to upper trophic-level receptors, including ecological and human receptors, via food webs.

The potential sources of contamination and the primary contaminant transport mechanisms identified in the WCSD indicate that there are both historical and ongoing sources of PAH contamination to the study area. Due to the persistence of PAHs in the environment, Skeet Range sediments may also be impacted by PAH sources located outside of the study area. These non-site-related PAH sources could account for the PAH concentrations detected in Skeet Range sediments. Therefore, existing analytical data, proximity to known or suspected non-Navy potential contributors, and the Navy's sediment policy (CNO, 2002) should be evaluated when estimating the Navy's potential contaminant contribution to the study area. Additionally, the potential for recontamination should be considered prior to remediation of sediment adjacent to Navy properties.

SECTION 5

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Tables

TABLE 1

Permitted Outfalls

Former Skeet and Trap Range #1 Watershed Contaminated Source Document

MCAS Cherry Point, North Carolina

Type of Permitted Outfalls	Receiving Water Body	Number of Sites	Activities Discharging to Outfall
Storm Water Outfall	Slocum Creek	2	Discharge from industrial areas including vehicle maintenance activiites and material storage sites
Storm Water Outfall	Slocum Creek	2	Discharge from the oil/water separators associated ith vehicle maintenance activities, material storage sites, aircraft refueling, and the flightline
Storm Water Outfall	Hancock Creek	1	Discharge from the oil/water separators associated ith vehicle maintenance activities, washdown activities,and the flightline
Wastewater Treatment Plant	Neuse River	2	Effluent from waste water treatment plant
Wastewater Treatment Plant	Hancock Creek	1	Effluent from waste water treatment plant
Wastewater Treatment Plant	East Prong of Slocum Creek	1	Effluent from waste water treatment plant

TABLE 2

Listed Sites on Navy Property

Former Skeet and Trap Range #1 Watershed Contaminated Source Document

MCAS Cherry Point, North Carolina

Type of Listed Site	Number of Listed Sites	Potential Contaminant Sources
CERCLA[1]	9	Petroleum, oil, lubricants, PAHs (benzo(a)pyrene, dibenz(a,h)anthracene, benzo(a)anthracene, benzo(b)fluranthene, indeno(1,2,3-cd)pyrene), inorganics
RCRA[2]	3	Petroleum, oil, lubricants, TPH- diesel, grease, inorganics
UST[3]	20	JP-5 (fuel pipeline, varosol, waste oil), #2 Fuel Oil, Diesel, AV Gasoline (waste oil/hydraulic fluid), kerosene, benzene

Notes:

[1] CERCLA sites with potential PAH detections

[2] RCRA sites along Slocum Creek in the vicinity of the Former Skeet and Trap Range #1

[3] UST Remedial Sites

TABLE 3

Listed Sites on non-Navy Property

Former Skeet and Trap Range #1 Watershed Contaminated Source Document

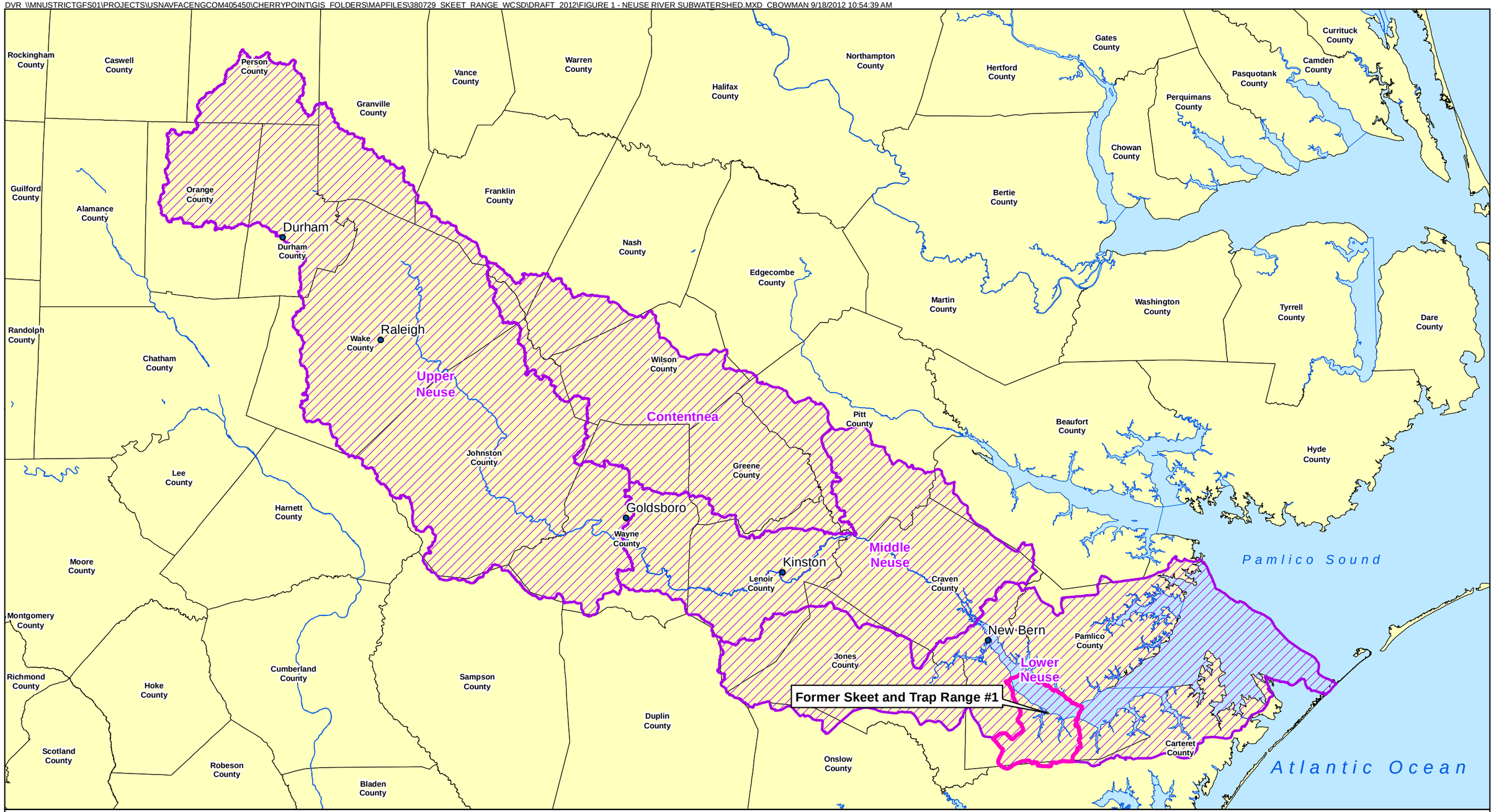
MCAS Cherry Point, North Carolina

Type of Listed Site	Number of Listed Sites	Contaminant Sources
RCRA	4	Diesel, other sources.
UST	28	Diesel, heating oil/fuel, kerosene, new and used oil.
Leaks and Spills	35	Diesel, heating/fuel oil, hydraulic fluid, kerosene, used oil, other petroleum products.
Historic Pollutant Sites	4	Contaminant sources not available.

Source: EDR, 2011

Figures

DVR \\MNUSTRICTGFS01\PROJECTS\USNAVFACENGCOM405450\CHERRYPOINT\GIS_FOLDERS\MAPFILES\380729_SKEET_RANGE_WCSD\DRAFT_2012\FIGURE 1 - NEUSE RIVER SUBWATERSHED.MXD CBOWMAN 9/18/2012 10:54:39 AM



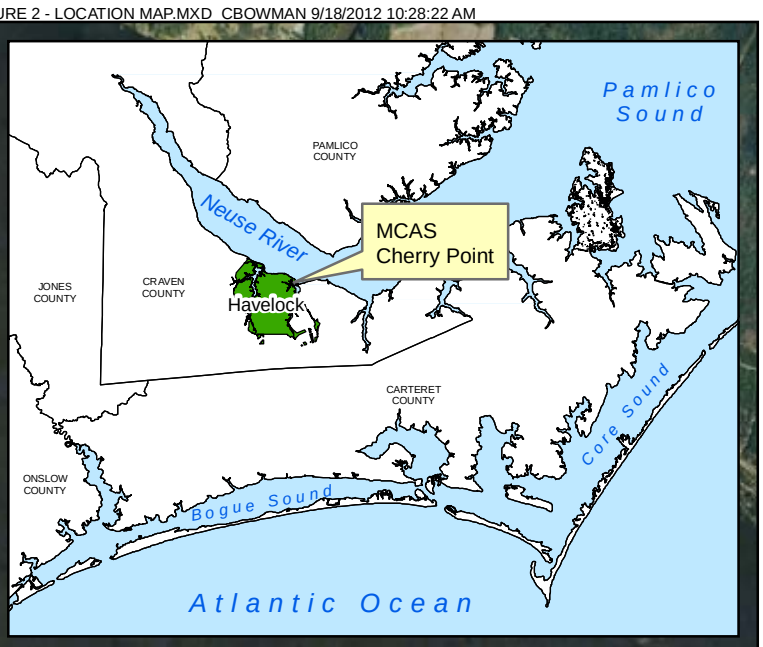
Legend

- Study Area
- Water Body
- Neuse River Watershed

Figure 1
Neuse River Watershed
Watershed Contaminated Source Document
MCAS Cherry Point
North Carolina

CH2MHILL

DVR \\MNUSTRICTGFS01\PROJECTS\USNAVFACENGCOM405450\CHERRYPOINT\GIS_FOLDERS\MAPFILES\380729_SKEET_RANGE_WCSD\DRAFT_2012\FIGURE 2 - LOCATION MAP.MXD CBOWMAN 9/18/2012 10:28:22 AM



Neuse River

Former Skeet and Trap Range #1

Slocum Creek

Hancock Creek

MCAS Cherry Point

101

70

Legend

- Theoretical Skeet Shotfall Zone
- Area of Maximum Skeet Shotfall
- Former Skeet and Trap Range #1
- Theoretical Trap Shotfall Zone
- Area of Maximum Trap Shotfall
- Installation Boundary

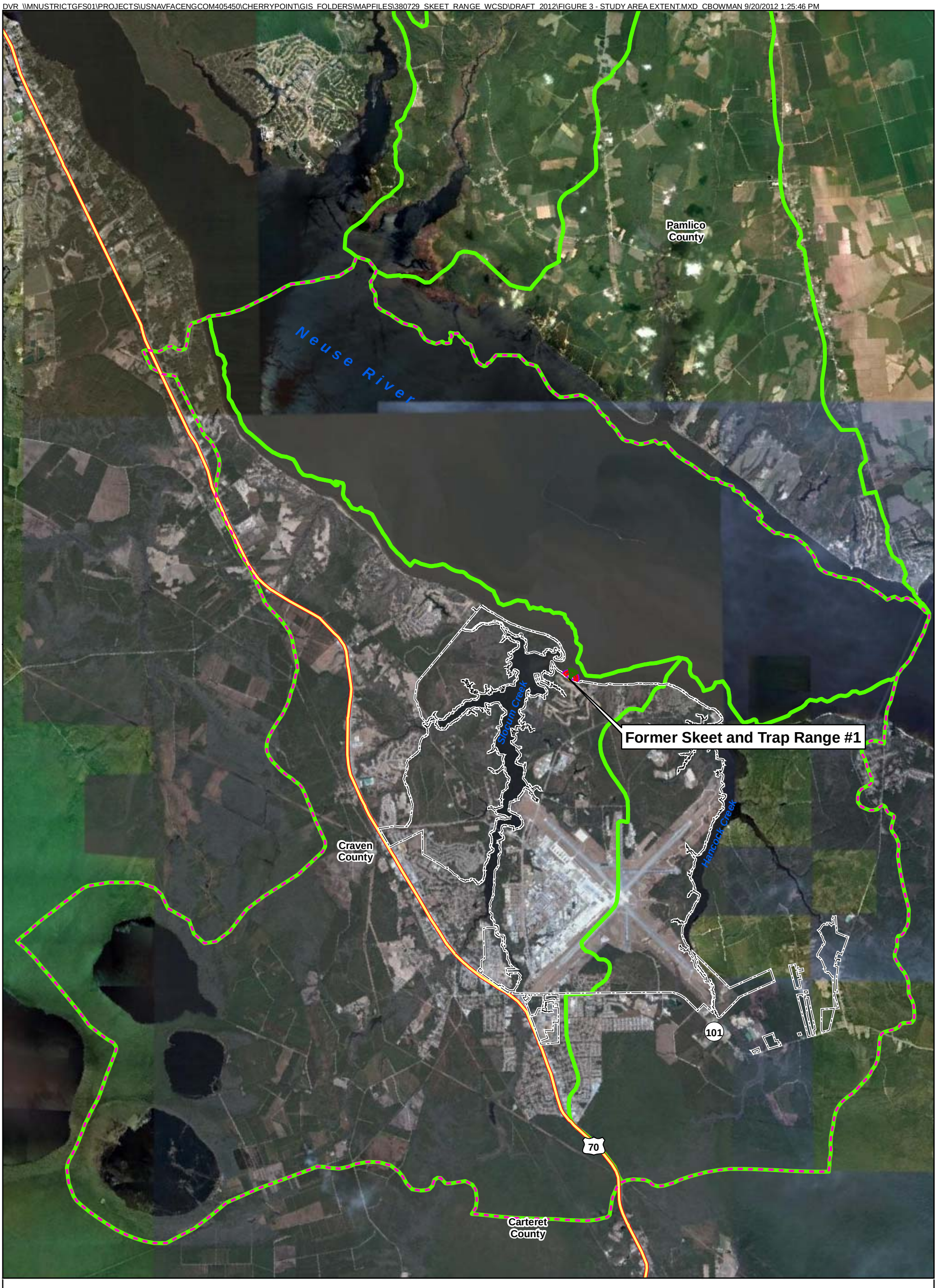
N
W E
S

0 1,750 3,500 7,000
Feet

Figure 2
Location Map
Watershed Contaminated Source Document
MCAS Cherry Point
North Carolina

CH2MHILL

DVR \\MNUSTRICTGFS01\PROJECTS\USNAVFACENGCOM405450\CHERRYPOINT\GIS_FOLDERS\MAPFILES\380729_SKEET_RANGE_WCSD\DRAFT_2012\FIGURE 3 - STUDY AREA EXTENT.MXD CBOWMAN 9/20/2012 1:25:46 PM



Legend

- Study Area
- North Carolina Watershed Areas
- Theoretical Skeet Shotfall Zone
- Area of Maximum Skeet Shotfall
- Former Skeet and Trap Range #1
- Theoretical Trap Shotfall Zone
- Area of Maximum Trap Shotfall
- Installation Boundary

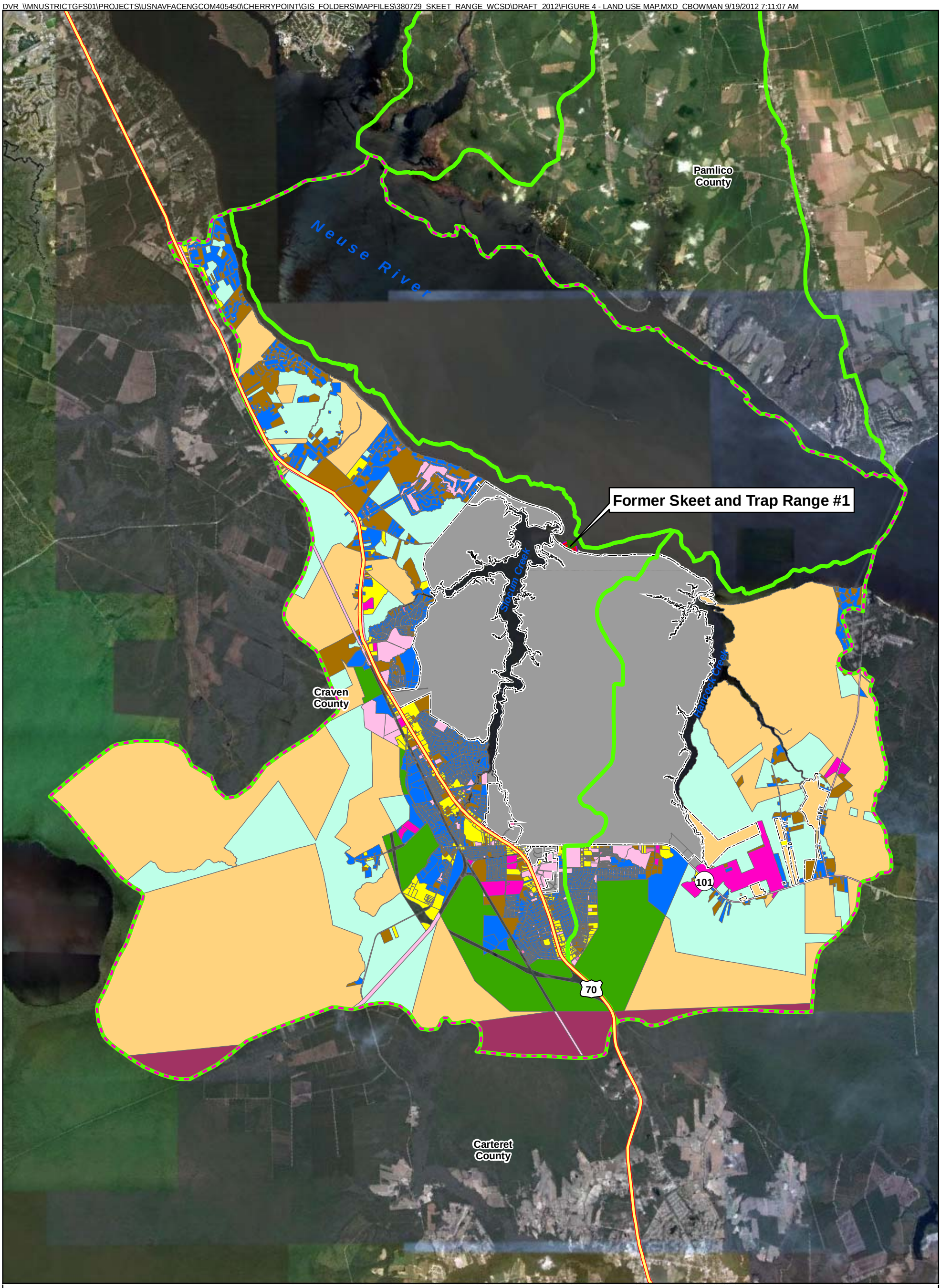
Figure 3
Study Area Extent
Watershed Contaminated Source Document
MCAS Cherry Point
North Carolina

N
W E
S

0 3,500 7,000 14,000
Feet

CH2MHILL

DVR \\MNUSTRICTGFS01\PROJECTS\USNAVFACENGCOM405450\CHERRYPOINT\GIS_FOLDERS\MAPFILES\380729_SKEET_RANGE_WCSD\DRAFT_2012\FIGURE 4 - LAND USE MAP.MXD CBOWMAN 9/19/2012 7:11:07 AM



Legend

- Study Area
- Theoretical Skeet Shotfall Zone
- Area of Maximum Skeet Shotfall
- Former Skeet and Trap Range #1
- Theoretical Trap Shotfall Zone
- Area of Maximum Trap Shotfall
- Installation Boundary
- North Carolina Watershed Areas

Land Use

- Agricultural
- Commercial
- Government and Public Facilities
- Industrial
- Institutional
- Military Installation
- No Information Available
- Residential
- U.S. National Forest
- Utilities
- Vacant

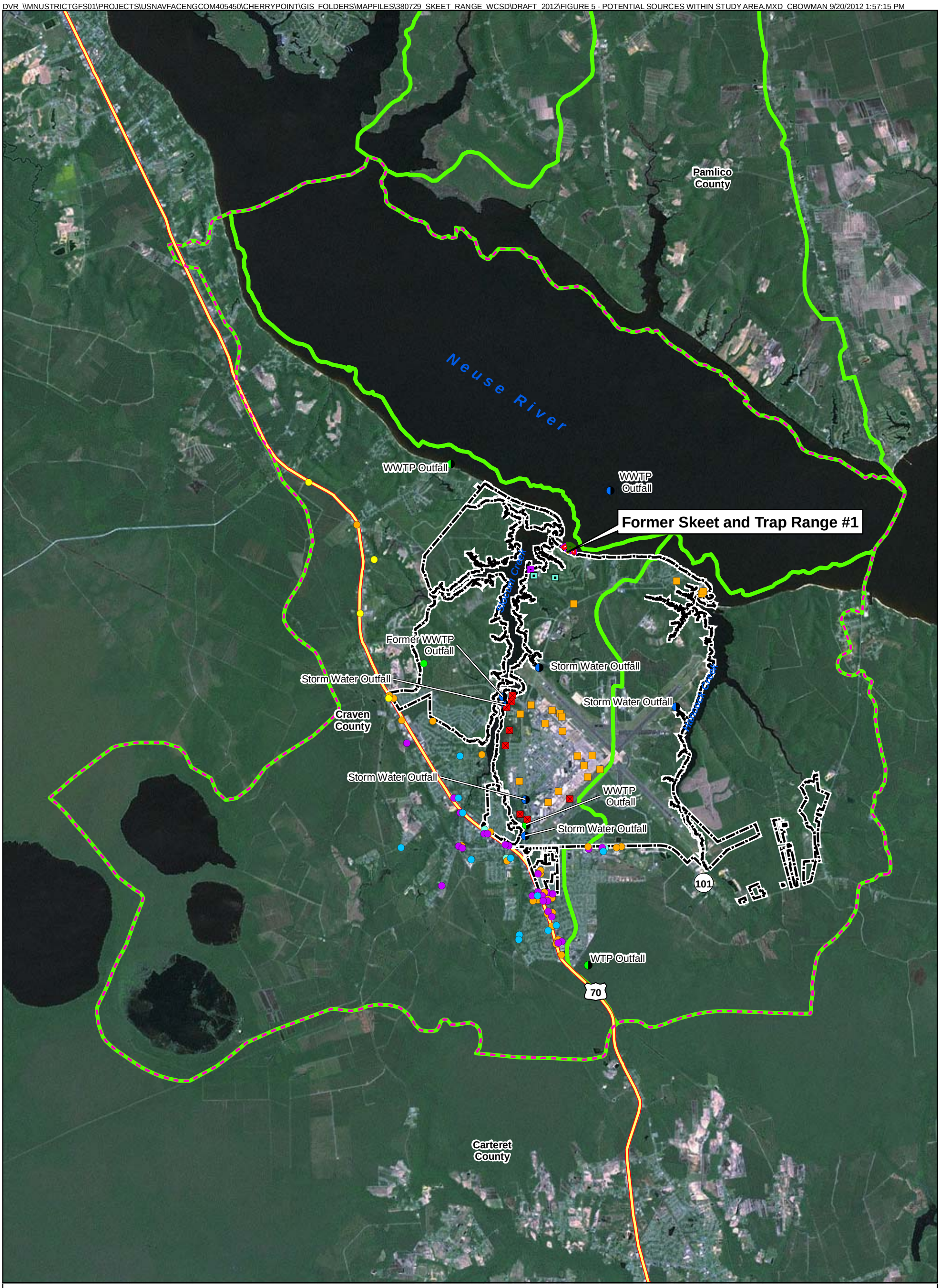
Figure 4
Land Use Map
Watershed Contaminated Source Document
Marine Corps Air Station Cherry Point
Cherry Point, North Carolina

N
W E
S

0 3,750 7,500 15,000
Feet

CH2MHILL

DVR \\MNUSTRICTGFS01\PROJECTS\USNAVFACENGCOM405450\CHERRYPOINT\GIS_FOLDERS\MAPFILES\380729_SKEET_RANGE_WCSD\DRAFT_2012\FIGURE 5 - POTENTIAL SOURCES WITHIN STUDY AREA.MXD CBOWMAN 9/20/2012 1:57:15 PM



Legend

- Navy Permitted Outfall
- Non-Navy Permitted Outfall

Navy Sites

- Belongs to more than one category
- RCRA
- UST
- CERCLA

Non - Navy Sites

- Belongs in more than one category
- RCRA
- UST
- Leaks and Spills
- Historic Pollutant Sites

- Study Area
- North Carolina Watershed Areas
- Theoretical Skeet Shotfall Zone
- Area of Maximum Skeet Shotfall
- Former Skeet and Trap Range #1
- Theoretical Trap Shotfall Zone
- Area of Maximum Trap Shotfall
- Installation Boundary

Figure 5
Potential Sources Within Study Area
Watershed Contaminated Source Document
MCAS Cherry Point, North Carolina

N
W E
S

0 3,750 7,500 15,000
Feet

CH2MHILL

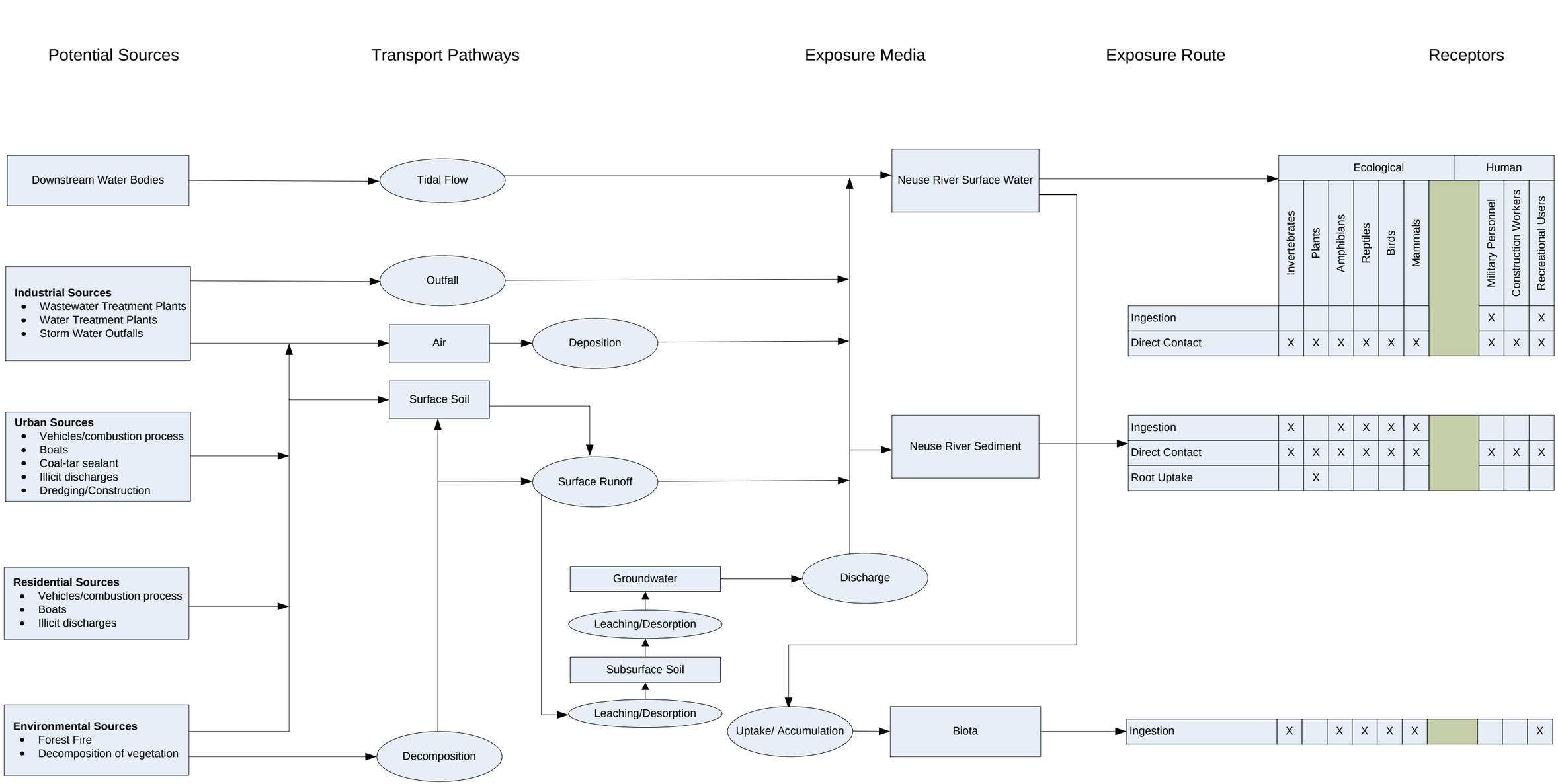


Figure 6
Diagrammatic Conceptual Site Model

Attachment A
Neuse River NOAA Analytical Results

DVR \\MNUSTRICTGFS01\PROJECTS\USNAVFACENGCOM405450\CHERRYPOINT\GIS_FOLDERS\MAPFILES\380729_SKEET_RANGE_WCSD\DRAFT_2012\FIGURE A-1 - NOAA SEDIMENT SAMPLING LOCATIONS.MXD CBOWMAN 9/21/2012 8:48:39 AM

Legend

- Sediment Sample Location (NOAA)
- Study Area
- NC Watershed Areas
- Theoretical Skeet Shotfall Zone
- Area of Maximum Skeet Shotfall
- Former Skeet and Trap Range #1
- Theoretical Trap Shotfall Zone
- Area of Maximum Trap Shotfall
- Installation Boundary

N W E S

0 0.75 1.5 3 Miles

Figure A-1
NOAA Sediment Sampling Locations
Cherry Point Watershed Map
Contaminated Source Document
Marine Corps Air Station Cherry Point
Cherry Point, North Carolina

CH2MHILL

TABLE A-1

NOAA Study PAH Results

Watershed Contaminated Source Document

MCAS Cherry Point, North Carolina

Station ID		NOAA-01		NOAA-02		NOAA-03		NOAA-04		NOAA-05		NOAA-06		NOAA-07	
Sample ID	**Adjusted Residential**	NR98_401	NR99_401	NR98_402	NR99_402	NR98_403	NR99_403	NR98_404	NR99_404	NR98_405	NR99_405	NR98_406	NR99_406	NR98_407	NR99_407
Sample Date	**Soil RSLs**	7/16/1998	11/11/1999	7/16/1998	11/11/1999	7/16/1998	11/11/1999	7/16/1998	11/11/1999	7/16/1998	11/11/1999	7/16/1998	11/11/1999	7/15/1998	11/10/1999
Chemical Name															
Semivolatile Organic Carbon (µg/kg)															
1,6,7-Trimethylnaphthalene	--	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	**5.56**
1-Methylnaphthalene	22,000	**6.01**	ND	**8.05**	ND	**7.56**	ND	**4.91**	ND	**6.24**	ND	**9.37**	ND	ND	**11.2**
1-Methylphenanthrene	--	ND	ND	**5.27**	ND	ND	ND	ND	ND	ND	ND	ND	ND	310	**27.1**
2,3,5-Trimethylnaphthalene	--	ND	NA	**2.38**	NA	ND	ND	ND	NA	ND	NA	ND	NA	32.3	NA
2,6-Dimethylnaphthalene	--	**3.57**	ND	**7.86**	ND	**4.62**	ND	ND	ND	**3.52**	ND	**5.24**	ND	ND	0
2-Methylnaphthalene	31,000	**10**	ND	**13.1**	ND	**12.5**	ND	**7.89**	ND	**9.04**	ND	16	ND	ND	**17.9**
Acenaphthene	340,000	ND	ND	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	**75.9**	0
Acenaphthylene	340,000	ND	ND	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**47.7**
Anthracene	1,700,000	ND	ND	**5.88**	ND	ND	ND	ND	ND	ND	ND	ND	ND	**13**	**24**
Benz[a]anthracene	150	ND	ND	**23**	ND	ND	ND	ND	ND	ND	ND	ND	ND	**1790**	**142**
Benzo[a]pyrene	15	ND	ND	**29.9**	ND	ND	ND	ND	ND	ND	ND	ND	ND	**1180**	**206**
Benzo[b]fluoranthene	150	ND	**8.26**	**43.4**	ND	ND	ND	ND	ND	ND	ND	ND	ND	**1370**	**208**
Benzo[b+j+k]fluoranthene	--	NA	**16.8**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**402**
Benzo[e]pyrene	--	ND	**7.62**	**29.1**	ND	ND	ND	ND	ND	ND	ND	ND	ND	**714**	**157**
Benzo[g,h,i]perylene	170,000	ND	**8.53**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**484**	**156**
Benzo[k]fluoranthene	1,500	ND	NA	**17.6**	NA	ND	NA	ND	NA	ND	NA	ND	NA	**599**	NA
Benzo[j+k]fluoranthene	--	NA	**8.54**	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	**194**
Biphenyl	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**13.9**
Chrysene	15,000	ND	NA	**33.7**	NA	ND	NA	ND	NA	ND	NA	ND	NA	**1750**	NA
Chrysene+Triphenylene	--	NA	**8.04**	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	**190**
Dibenz[a,h]anthracene	15	ND	**2.14**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**113**	**35.9**
Dibenzothiophene	--	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	**9.28**
Fluoranthene	230,000	ND	**12.2**	**53.5**	ND	ND	ND	ND	ND	ND	ND	ND	ND	**3960**	**415**
Fluorene	230,000	ND	ND	**4.34**	ND	ND	ND	ND	ND	ND	ND	ND	ND	**202**	**17**
Indeno[1,2,3-c,d]pyrene	150	ND	ND	**19.9**	ND	ND	ND	ND	ND	ND	ND	ND	ND	**555**	**127**
Naphthalene	3,600	**8.61**	ND	ND	ND	**11.6**	ND	ND	ND	ND	ND	**12.2**	ND	ND	**96.8**
Perylene	--	ND	**109**	**381**	**6.57**	ND	**6.695**	ND	**6.95**	**4.88**	ND	**9.98**	ND	**325**	**101**
Phenanthrene	1,700,000	ND	**3.66**	**28.2**	ND	ND	ND	ND	ND	ND	ND	**3.37**	ND	**1100**	**193**
Pyrene	170,000	ND	**13.2**	**68.8**	ND	ND	ND	ND	ND	ND	ND	ND	ND	**3380**	**446**

Notes:

Red exceeds RSLs

Bold is detected values

µg/kg - micrograms per kilogram

NA - not analyzed for

ND - not detected

TABLE A-1

NOAA Study PAH Results

Watershed Contaminated Source Document

MCAS Cherry Point, North Carolina

Station ID		NOAA-08		NOAA-09		NOAA-10		NOAA-11		NOAA-12		NOAA-13		NOAA-14	
Sample ID	**Adjusted Residential**	NR98_408	NR99_408	NR98_409	NR99_409	NR98_410	NR99_410	NR98_411	NR99_411	NR98_412	NR99_412	NR98_413	NR99_413	NR98_414	NR99_414
Sample Date	**Soil RSLs**	7/15/1998	11/10/1999	7/15/1998	11/10/1999	7/15/1998	11/10/1999	7/15/1998	11/10/1999	7/14/1998	11/10/1999	7/14/1998	11/8/1999	7/14/1998	11/10/1999
Chemical Name															
Semivolatile Organic Carbon (µg/kg)															
1,6,7-Trimethylnaphthalene	--	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND
1-Methylnaphthalene	22,000	**6.81**	ND	**5.72**	ND	**27.9**	ND	**33.2**	ND	**6.95**	ND	**5.92**	ND	**5.95**	ND
1-Methylphenanthrene	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,3,5-Trimethylnaphthalene	--	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA
2,6-Dimethylnaphthalene	--	ND	ND	ND	ND	**17.7**	**10.1**	**22.7**	ND	ND	ND	**4.16**	ND	**3.71**	ND
2-Methylnaphthalene	31,000	**10.2**	ND	**8.84**	ND	**47.5**	**14.8**	**50.9**	ND	**10.6**	ND	**10.2**	ND	**9.36**	ND
Acenaphthene	340,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acenaphthylene	340,000	ND	ND	ND	ND	ND	**10.5**	ND	**6.53**	ND	**4.04**	ND	ND	ND	ND
Anthracene	1,700,000	ND	ND	ND	ND	ND	**9.93**	ND	ND	ND	ND	ND	ND	ND	ND
Benz[a]anthracene	150	ND	ND	ND	ND	**54.8**	**51.3**	ND	**24.75**	ND	ND	ND	ND	ND	ND
Benzo[a]pyrene	15	ND	ND	ND	ND	**68.5**	**65.1**	ND	**33.15**	ND	**12.2**	ND	ND	ND	ND
Benzo[b]fluoranthene	150	ND	ND	**6.87**	ND	**114**	**99.1**	**49.1**	**48.9**	ND	**9.62**	ND	ND	ND	ND
Benzo[b+j+k]fluoranthene	--	NA	NA	NA	NA	NA	**174**	NA	**85.15**	NA	**18.94**	NA	NA	NA	NA
Benzo[e]pyrene	--	ND	ND	**5.82**	ND	**63.6**	**65.3**	**30.8**	**36.65**	ND	**10.5**	ND	ND	ND	ND
Benzo[g,h,i]perylene	170,000	ND	ND	ND	ND	**54.5**	**64**	ND	**46.05**	ND	**18.1**	ND	ND	ND	ND
Benzo[k]fluoranthene	1,500	ND	NA	ND	NA	**54.4**	NA	**25.6**	NA	ND	NA	ND	NA	ND	NA
Benzo[j+k]fluoranthene	--	NA	ND	NA	ND	NA	**74.9**	NA	**36.25**	NA	**9.32**	NA	ND	NA	ND
Biphenyl	--	ND	ND	ND	ND	ND	**21.4**	ND	ND	ND	ND	ND	ND	ND	ND
Chrysene	15,000	0	NA	**4.26**	NA	**87.4**	NA	**29.4**	NA	**2.44**	NA	ND	NA	ND	NA
Chrysene+Triphenylene	--	NA	ND	NA	ND	NA	**72.8**	NA	**37.1**	NA	**12**	NA	ND	NA	ND
Dibenz[a,h]anthracene	15	ND	ND	**1.98**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dibenzothiophene	--	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND
Fluoranthene	230,000	ND	ND	**6.65**	ND	**162**	**152**	**65.3**	**64.5**	**5.51**	**43.4**	ND	ND	ND	ND
Fluorene	230,000	ND	ND	ND	ND	**9.39**	**11**	ND	ND	ND	ND	ND	ND	ND	ND
Indeno[1,2,3-c,d]pyrene	150	ND	ND	ND	ND	**69.8**	**47.7**	**38.8**	**36.7**	ND	**11.1**	ND	ND	ND	ND
Naphthalene	3,600	ND	ND	ND	ND	**43.5**	**27.4**	**49.9**	ND	ND	ND	ND	ND	ND	ND
Perylene	--	**63.8**	**8.88**	**7.86**	**8.24**	**267**	**346**	**58.1**	**85.95**	**7.22**	**11**	ND	ND	ND	ND
Phenanthrene	1,700,000	**4.54**	ND	**5.53**	ND	**67.5**	**55.7**	**32.1**	**22.25**	**5.05**	**28.7**	**3.27**	ND	**3.22**	ND
Pyrene	170,000	**4.18**	ND	**8.18**	**2.9**	**164**	**146**	**76.5**	**68.55**	**6.31**	**54.1**	ND	ND	ND	ND

Notes:

Red exceeds RSLs

Bold is detected values

µg/kg - micrograms per kilogram

NA - not analyzed for

ND - not detected

TABLE A-1

NOAA Study PAH Results

Watershed Contaminated Source Document

MCAS Cherry Point, North Carolina

Station ID		NOAA-15		NOAA-16		NOAA-17		NOAA-18		NOAA-19		NOAA-20	
Sample ID	**Adjusted Residential**	NR98_415	NR99_415	NR98_416	NR99_416	NR98_417	NR99_417	NR98_418	NR99_418	NR98_419	NR99_419	NR98_420	NR99_420
Sample Date	**Soil RSLs**	7/14/1998	11/10/1999	7/14/1998	11/8/1999	7/13/1998	11/8/1999	7/13/1998	11/9/1999	7/13/1998	11/9/1999	7/14/1998	11/8/1999
Chemical Name													
Semivolatile Organic Carbon (µg/kg)													
1,6,7-Trimethylnaphthalene	--	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND
1-Methylnaphthalene	22,000	**9.84**	ND	**41.2**	ND	**15.6**	ND	**6.34**	ND	**6.64**	ND	**5.59**	ND
1-Methylphenanthrene	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,3,5-Trimethylnaphthalene	--	ND	NA	**6.65**	NA	**4.77**	NA	**2.37**	NA	**1.78**	NA	ND	NA
2,6-Dimethylnaphthalene	--	**5.95**	ND	**21**	ND	**9.97**	ND	**4.14**	ND	**4.39**	ND	**3.54**	ND
2-Methylnaphthalene	31,000	**17**	ND	**63.9**	ND	**25**	ND	**9.22**	ND	**10.9**	ND	**8.5**	ND
Acenaphthene	340,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acenaphthylene	340,000	ND	ND	ND	ND	ND	**3.36**	ND	ND	ND	ND	ND	ND
Anthracene	1,700,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benz[a]anthracene	150	ND	ND	ND	ND	**23.5**	**16.7**	ND	ND	ND	ND	ND	ND
Benzo[a]pyrene	15	ND	ND	ND	ND	**28.1**	**19.6**	ND	ND	ND	ND	ND	ND
Benzo[b]fluoranthene	150	ND	ND	**25.1**	**25.5**	**32.7**	**21.4**	ND	ND	ND	ND	ND	ND
Benzo[b+j+k]fluoranthene	--	NA	NA	NA	46	NA	**38.9**	NA	NA	NA	NA	NA	NA
Benzo[e]pyrene	--	ND	ND	**17**	**18.2**	**18.9**	**16.2**	ND	ND	ND	ND	ND	ND
Benzo[g,h,i]perylene	170,000	ND	ND	ND	**23.3**	**25.1**	**18**	ND	ND	ND	ND	ND	ND
Benzo[k]fluoranthene	1,500	ND	NA	ND	NA	**12.6**	NA	ND	NA	ND	NA	ND	NA
Benzo[j+k]fluoranthene	--	NA	ND	NA	**20.5**	NA	**17.5**	NA	ND	NA	ND	NA	ND
Biphenyl	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chrysene	15,000	ND	NA	**16.8**	NA	**24.9**	NA	ND	NA	ND	NA	ND	NA
Chrysene+Triphenylene	--	NA	ND	NA	**17.7**	NA	**22.7**	NA	ND	NA	ND	NA	ND
Dibenz[a,h]anthracene	15	ND	ND	ND	**5**	ND	**6.53**	ND	ND	ND	ND	ND	ND
Dibenzothiophene	--	NA	ND	NA	ND	NA	0	NA	ND	NA	ND	NA	ND
Fluoranthene	230,000	ND	ND	**35.9**	**31.6**	**47.8**	**37.6**	ND	ND	ND	ND	ND	ND
Fluorene	230,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Indeno[1,2,3-c,d]pyrene	150	ND	ND	ND	ND	**26.2**	**18.8**	ND	ND	ND	ND	ND	ND
Naphthalene	3,600	**12.6**	ND	**54.9**	ND	**24.3**	ND	ND	ND	**9.72**	ND	ND	ND
Perylene	--	ND	ND	**44.9**	**57.5**	**16.6**	**21.1**	ND	ND	ND	ND	ND	ND
Phenanthrene	1,700,000	**4.83**	ND	**24.6**	**10.8**	**18.3**	**16**	**3.28**	ND	**5.32**	ND	ND	ND
Pyrene	170,000	ND	ND	**38.6**	**34.1**	**69.4**	**47.4**	ND	ND	**4.15**	**3.57**	ND	ND

Notes:

Red exceeds RSLs

Bold is detected values

µg/kg - micrograms per kilogram

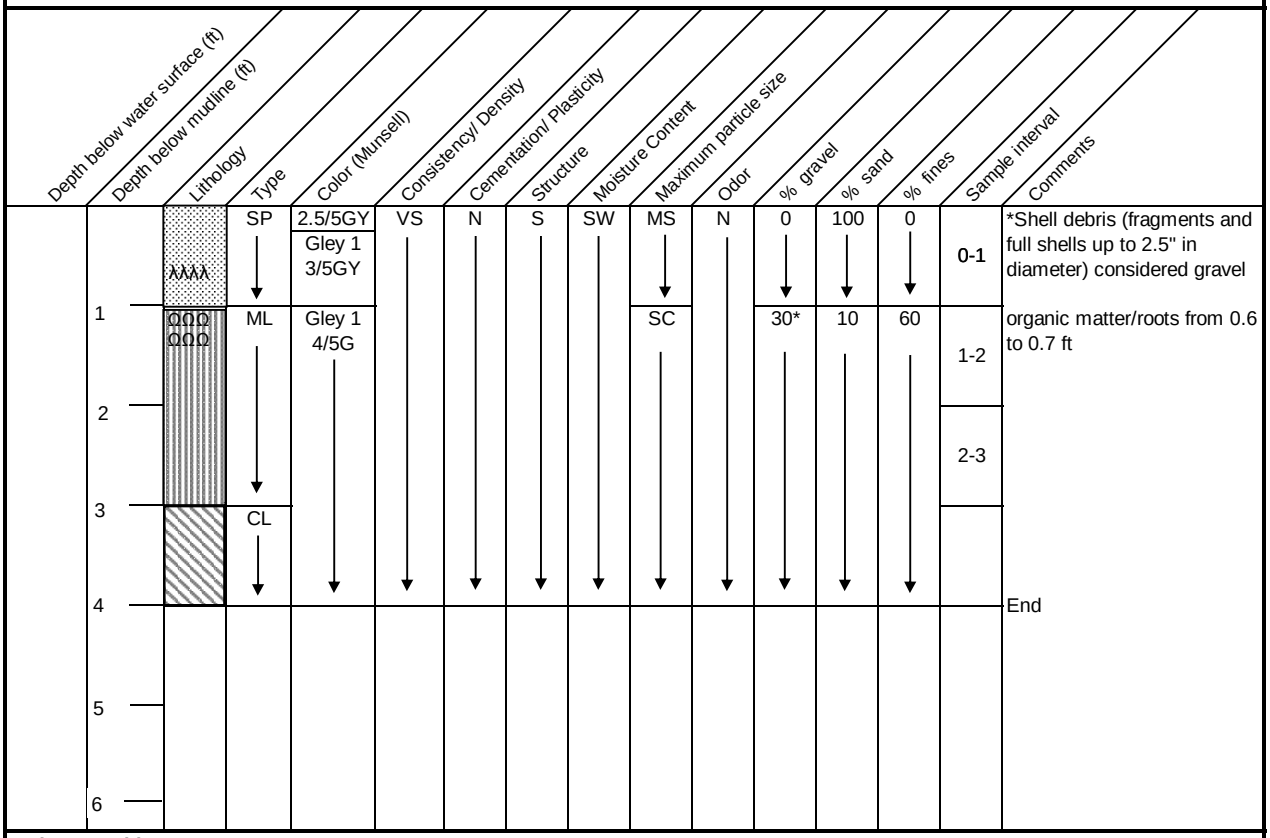
NA - not analyzed for

ND - not detected

Appendix B
2012 Sediment Core Boring Logs

Site Name: Former Skeet and Trap Range #1
Project Name: Site Inspection for Former Skeet and Trap Range #1
Project Number: 362275
Survey Duration: 5/18/09-5/22/09

Station ID:	STR01-SD01	**Northing:**	443024.15		**Attempt 1**
Sampler(s):	T. Himmer/BOS	**Easting:**	2632102.62	**Penetration (ft):**	4.0'
	R. Clore/CHC	**Datum:**	NC State Plane	**Recovery (ft)**	4.0'
	J. Diner/RDU	**Depth:**	2.1'	**Time:**	901 5/21/09
Survey Crew:	Catlin	**Tide:**	N/A		**Attempt 2**
		St. Arrival:	0853	**Penetration (ft):**	NA
Vessel:	RV Vibracore 2	**St. Depart**	0911	**Recovery (ft)**	NA
Collection:	Vibracore/pushcore	**Logged by:**	R.Clore/J.Diner	**Time:**	NA
Weather:	70's clear sunny				



Photographic Log:

Photo file name	Date	Initials	Subject of Photo
SD01-0-1	**5/21/09**	**JD**	
SD01-1-2	**5/21/09**	**JD**	
SD01-2-3	**5/21/09**	**JD**	

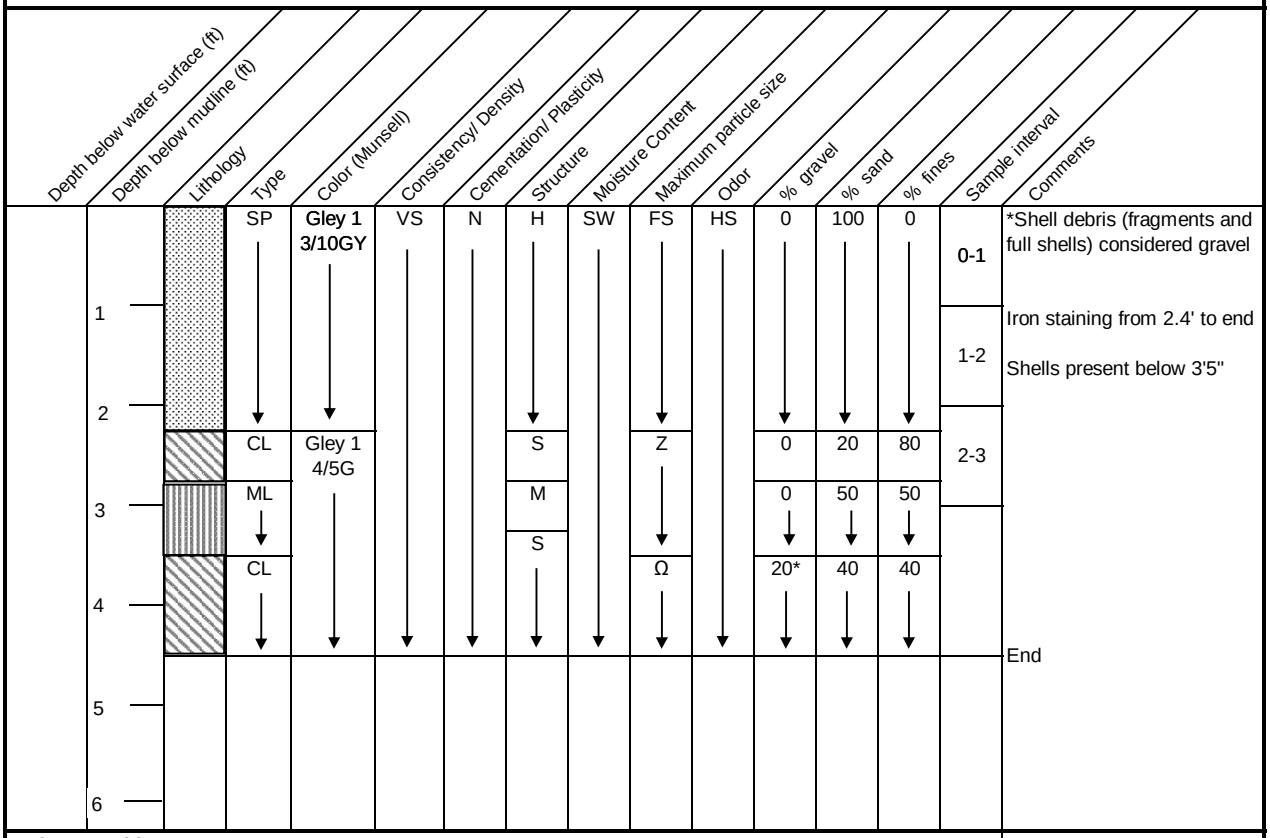
Sample Summary (check boxes for analysis):

Sample ID	Total Metals/Hg/PAHs	TOC	GS	Interval sampled (ft)	Time
STR01-SD01-0-1-0509	**X**			**0-1**	**0901**
STR01-SD01-1-2-0509	**X**			**1-2**	**0901**
STR01-SD01-2-3-0509	**X**			**2-3**	**0901**

Reviewed by: T. Himmer/BOS Date: 5/25/2009

Site Name: Former Skeet and Trap Range #1
Project Name: Site Inspection for Former Skeet and Trap Range #1
Project Number: 362275
Survey Duration: 5/18/09-5/22/09

Station ID:	STR01-SD02	**Northing:**	443129.42		**Attempt 1**
Sampler(s):	T. Himmer/BOS	**Easting:**	2631938.79	**Penetration (ft):**	4.3'
	R. Clore/CHC	**Datum:**	NC State Plane	**Recovery (ft)**	4.3'
	J. Diner/RDU	**Depth:**	2.2'	**Time:**	927 5/21/09
Survey Crew:	Catlin	**Tide:**	N/A		**Attempt 2**
		St. Arrival:	0925	**Penetration (ft):**	NA
Vessel:	RV Vibracore 2	**St. Depart**	0937	**Recovery (ft)**	NA
Collection:	Vibracore/pushcore	**Logged by:**	R. Clore/J. Diner	**Time:**	NA
Weather:	70's clear sunny				



Photographic Log:

Photo file name	Date	Initials	Subject of Photo
SD02-0-1	**5/21/09**	**JD**	
SD02-1-2	**5/21/09**	**JD**	
SD02-2-3	**5/21/09**	**JD**	

Sample Summary (check boxes for analysis):

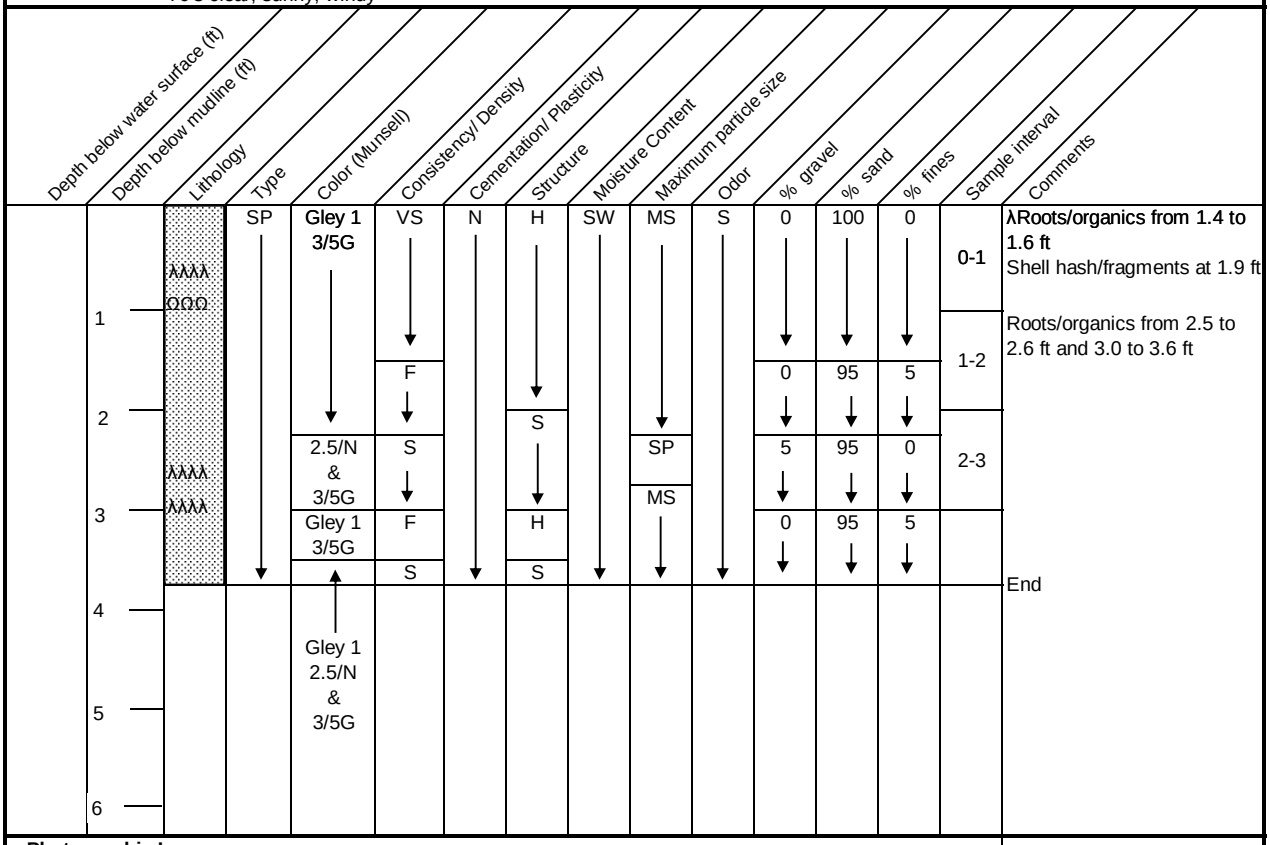
Sample ID	Total Metals/Hg/PAHs	TOC	GS	Interval sampled (ft)	Time
STR01-SD02-0-1-0509	**X**			**0-1**	**0927**
STR01-SD02-1-2-0509	**X**			**1-2**	**0927**
STR01-SD02-2-3-0509	**X**			**2-3**	**0927**

Reviewed by: T. Himmer/BOS Date: 5/25/2009

CH2MHILL

Site Name: Former Skeet and Trap Range #1
Project Name: Site Inspection for Former Skeet and Trap Range #1
Project Number: 362275
Survey Duration: 5/18/09-5/22/09

Station ID:	STR01-SD03	**Northing:**	443173.73		**Attempt 1**
Sampler(s):	T. Himmer/BOS	**Easting:**	2631667.3	**Penetration (ft):**	3.75
	R. Clore/CHC	**Datum:**	NC State Plane	**Recovery (ft)**	3.6
	J. Diner/RDU	**Depth:**	2.1'	**Time:**	952 5/21/09
Survey Crew:	Catlin	**Tide:**	N/A		**Attempt 2**
		St. Arrival:	0948	**Penetration (ft):**	NA
Vessel:	RV Vibracore 2	**St. Depart**	1000	**Recovery (ft)**	NA
Collection:	Vibracore/pushcore	**Logged by:**	R. Clore/J. Diner	**Time:**	NA
Weather:	70's clear, sunny, windy				



Photographic Log:

Photo file name	Date	Initials	Subject of Photo
SD03-0-1	**5/21/09**	**JD**	
SD03-1-2	**5/21/09**	**JD**	
SD03-2-3	**5/21/09**	**JD**	

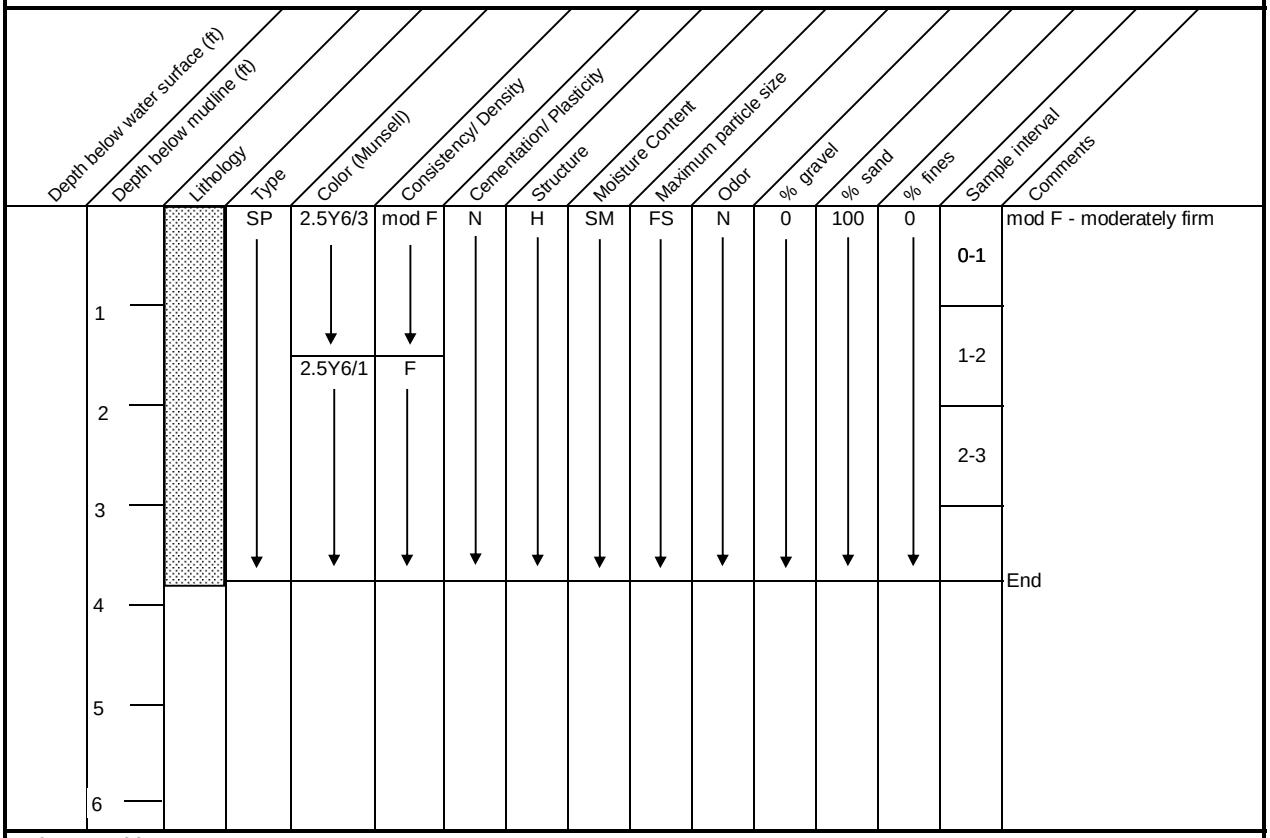
Sample Summary (check boxes for analysis):

Sample ID	Total Metals/Hg/PAHs	TOC	GS	Interval sampled (ft)	Time
STR01-SD03-0-1-0509	**X**			**0-1**	**0952**
STR01-SD03-1-2-0509	**X**			**1-2**	**0952**
STR01-SD03-2-3-0509	**X**			**2-3**	**0952**

Reviewed by: T. Himmer/BOS Date: 5/25/2009

Site Name: Former Skeet and Trap Range #1
Project Name: Site Inspection for Former Skeet and Trap Range #1
Project Number: 362275
Survey Duration: 5/18/09-5/22/09

Station ID:	STR01-SD04	**Northing:**	443277.15		**Attempt 1**
Sampler(s):	T. Himmer/BOS	**Easting:**	2631463.19	**Penetration (ft):**	3.7'
	R. Clore/CHC	**Datum:**	NC State Plane	**Recovery (ft)**	3.7'
	J. Diner/RDU	**Depth:**	2.3'	**Time:**	1147 5/21/09
Survey Crew:	Catlin	**Tide:**	N/A		**Attempt 2**
		St. Arrival:	1142	**Penetration (ft):**	NA
Vessel:	RV Vibracore 2	**St. Depart**	1153	**Recovery (ft)**	NA
Collection:	Vibracore/pushcore	**Logged by:**	T. Himmer	**Time:**	NA
Weather:	70's clear sunny				



Photographic Log:

Photo file name	Date	Initials	Subject of Photo
SD04-0-1	**5/21/09**	**TH/RC**	
SD04-1-2	**5/21/09**	**TH/RC**	
SD04-2-3	**5/21/09**	**TH/RC**	

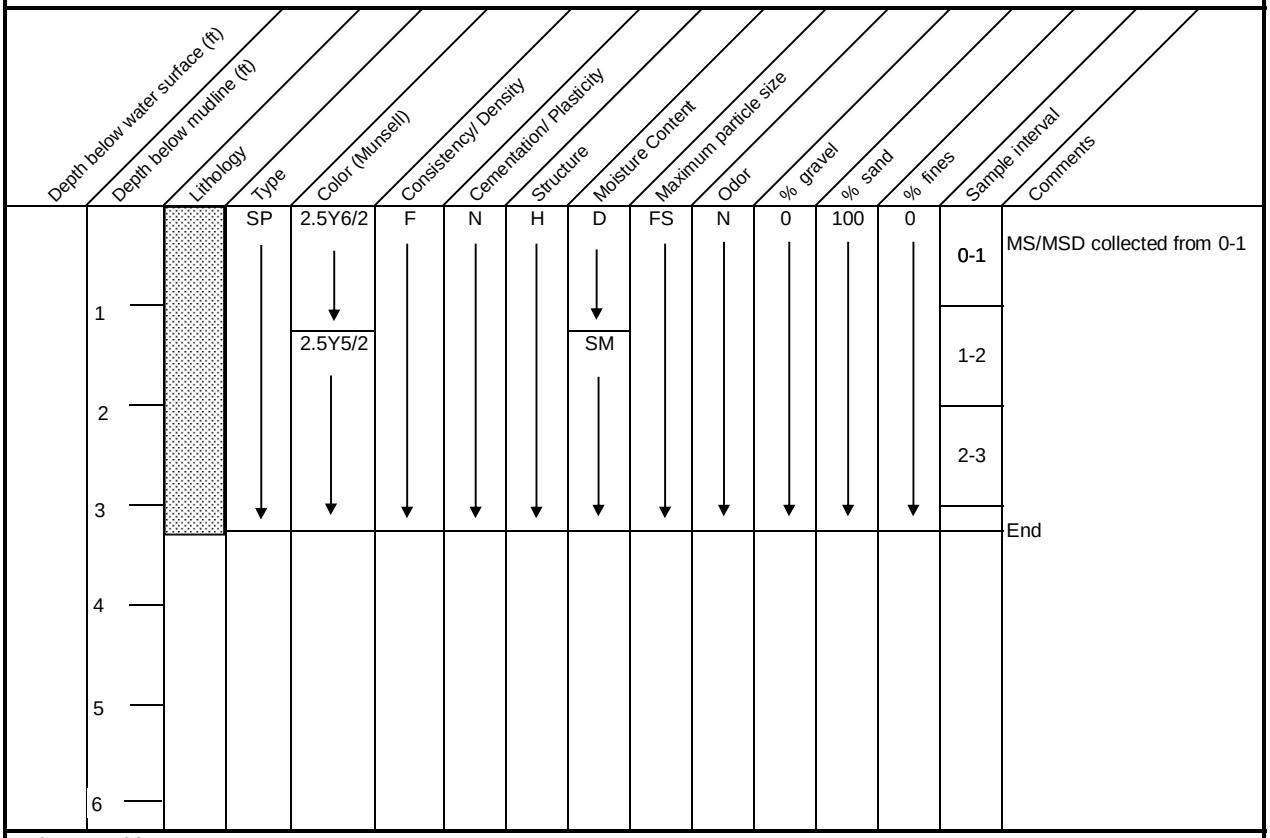
Sample Summary (check boxes for analysis):

Sample ID	Total Metals/Hg/PAHs	TOC	GS	Interval sampled (ft)	Time
STR01-SD04-0-1-0509	**X**	**X**	**X**	**0-1**	**1147**
STR01-SD04-1-2-0509	**X**	**X**	**X**	**1-2**	**1147**
STR01-SD04-2-3-0509	**X**	**X**	**X**	**2-3**	**1147**

Reviewed by: T. Himmer/BOS Date: 5/25/2009

Site Name: Former Skeet and Trap Range #1
Project Name: Site Inspection for Former Skeet and Trap Range #1
Project Number: 362275
Survey Duration: 5/18/09-5/22/09

Station ID:	STR01-SD05	**Northing:**	443492.24		**Attempt 1**
Sampler(s):	T. Himmer/BOS	**Easting:**	2631303.04	**Penetration (ft):**	3.5'
	R. Clore/CHC	**Datum:**	NC State Plane	**Recovery (ft)**	3.3'
	J. Diner/RDU	**Depth:**	2.8'	**Time:**	1125 5/21/09
Survey Crew:	Catlin	**Tide:**	N/A		**Attempt 2**
		St. Arrival:	1120	**Penetration (ft):**	NA
Vessel:	RV Vibracore 2	**St. Depart**	1133	**Recovery (ft)**	NA
Collection:	Vibracore/pushcore	**Logged by:**	T. Himmer	**Time:**	NA
Weather:	70's clear sunny				



Photographic Log:

Photo file name	Date	Initials	Subject of Photo
SD05-0-1	**5/21/09**	**TH/RC**	
SD05-1-2	**5/21/09**	**TH/RC**	
SD05-2-3	**5/21/09**	**TH/RC**	

Sample Summary (check boxes for analysis):

Sample ID	Total Metals/Hg/PAHs	TOC	GS	Interval sampled (ft)	Time
STR01-SD05-0-1-0509	**X**			**0-1**	**1125**
STR01-SD05-0-1-0509-MS	**X**			**0-1**	**1125**
STR01-SD05-0-1-0509-SD	**X**			**0-1**	**1125**
STR01-SD05-1-2-0509	**X**			**1-2**	**1125**
STR01-SD05-2-3-0509	**X**			**2-3**	**1125**

Reviewed by: T. Himmer/BOS Date: 5/25/2009

Site Name: Former Skeet and Trap Range #1
Project Name: Site Inspection for Former Skeet and Trap Range #1
Project Number: 362275
Survey Duration: 5/18/09-5/22/09

Station ID:	STR01-SD06	**Northing:**	443559.52		**Attempt 1**
Sampler(s):	T. Himmer/BOS	**Easting:**	2631124.18	**Penetration (ft):**	3.7'
	R. Clore/CHC	**Datum:**	NC State Plane	**Recovery (ft)**	3.6'
	J. Diner/RDU	**Depth:**	2.5'	**Time:**	1107 5/21/09
Survey Crew:	Catlin	**Tide:**	N/A		**Attempt 2**
		St. Arrival:	1100	**Penetration (ft):**	NA
Vessel:	RV Vibracore 2	**St. Depart**	1115	**Recovery (ft)**	NA
Collection:	Vibracore/pushcore	**Logged by:**	T. HImmer	**Time:**	NA
Weather:	70's clear sunny				

Depth below water surface (ft)	Depth below mudline (ft)	Lithology	Type	Color (Munsell)	Consistency/ Density	Cementation/ Plasticity	Structure	Moisture Content	Maximum particle size	Odor	% gravel	% sand	% fines	Sample interval	Comments
			SP	2.5Y5/2	F	N	H	SM	FS	N	0	100	0	0-1	
	1													1-2	
	2													2-3	
	3														End
	4														
	5														
	6														

Photographic Log:

Photo file name	Date	Initials	Subject of Photo
SD06-0-1	**5/21/09**	**TH/RC**	
SD06-1-2	**5/21/09**	**TH/RC**	
SD06-2-3	**5/21/09**	**TH/RC**	

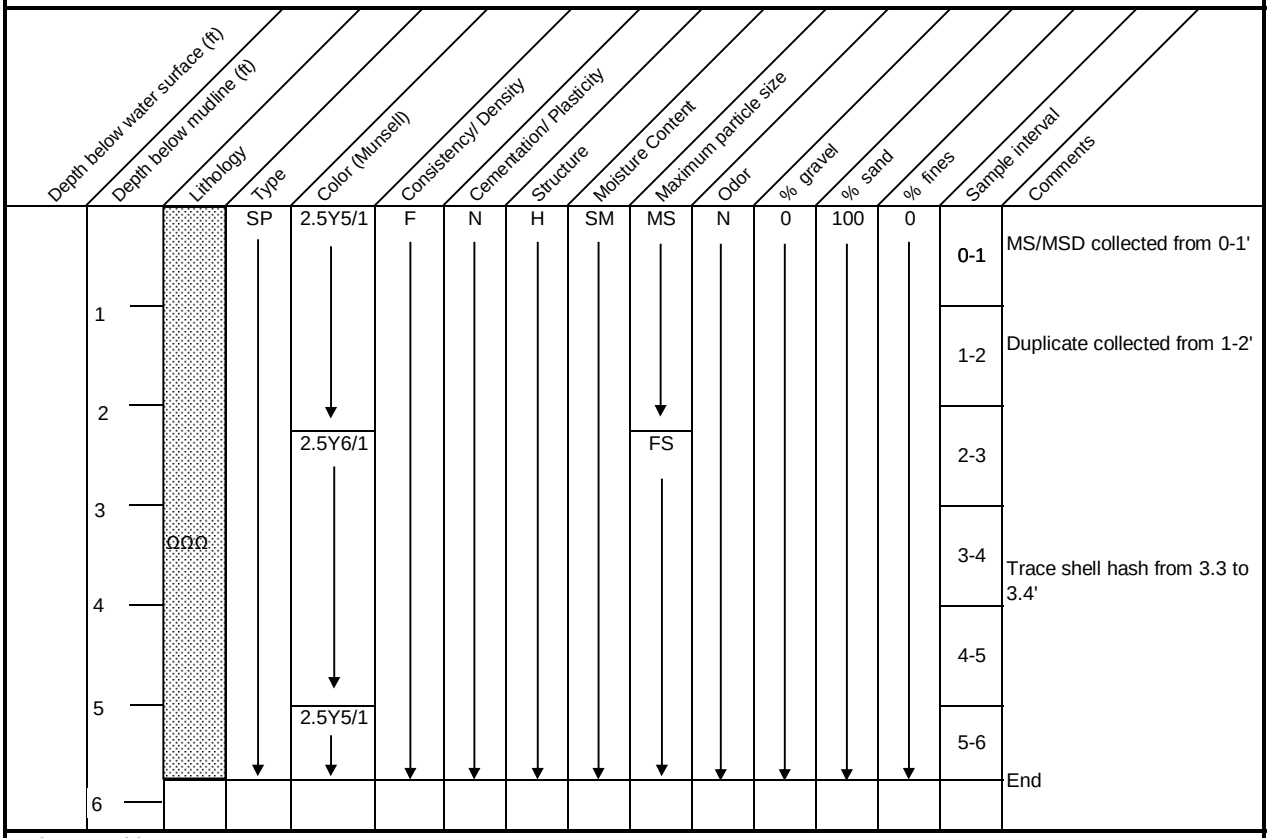
Sample Summary (check boxes for analysis):

Sample ID	Total Metals/Hg/PAHs	TOC	GS	Interval sampled (ft)	Time
STR01-SD06-0-1-0509	**X**			**0-1**	**1107**
STR01-SD06-1-2-0509	**X**			**1-2**	**1107**
STR01-SD06-2-3-0509	**X**			**2-3**	**1107**

Reviewed by: T. Himmer/BOS Date: 5/25/2009

Site Name: Former Skeet and Trap Range #1
Project Name: Site Inspection for Former Skeet and Trap Range #1
Project Number: 362275
Survey Duration: 5/18/09-5/22/09

Station ID:	STR01-SD07	**Northing:**	443498.78		**Attempt 1**
Sampler(s):	T. Himmer/BOS	**Easting:**	2631567.76	**Penetration (ft):**	6.0'
	R. Clore/CHC	**Datum:**	NC State Plane	**Recovery (ft)**	5.8'
	J. Diner/RDU	**Depth:**	5.6'	**Time:**	1205 5/21/09
Survey Crew:	Catlin	**Tide:**	N/A		**Attempt 2**
		St. Arrival:	1200	**Penetration (ft):**	NA
Vessel:	RV Vibracore 2	**St. Depart**	1215	**Recovery (ft)**	NA
Collection:	Vibracore/pushcore	**Logged by:**	T. Himmer	**Time:**	NA
Weather:	70's clear sunny				



Photographic Log:

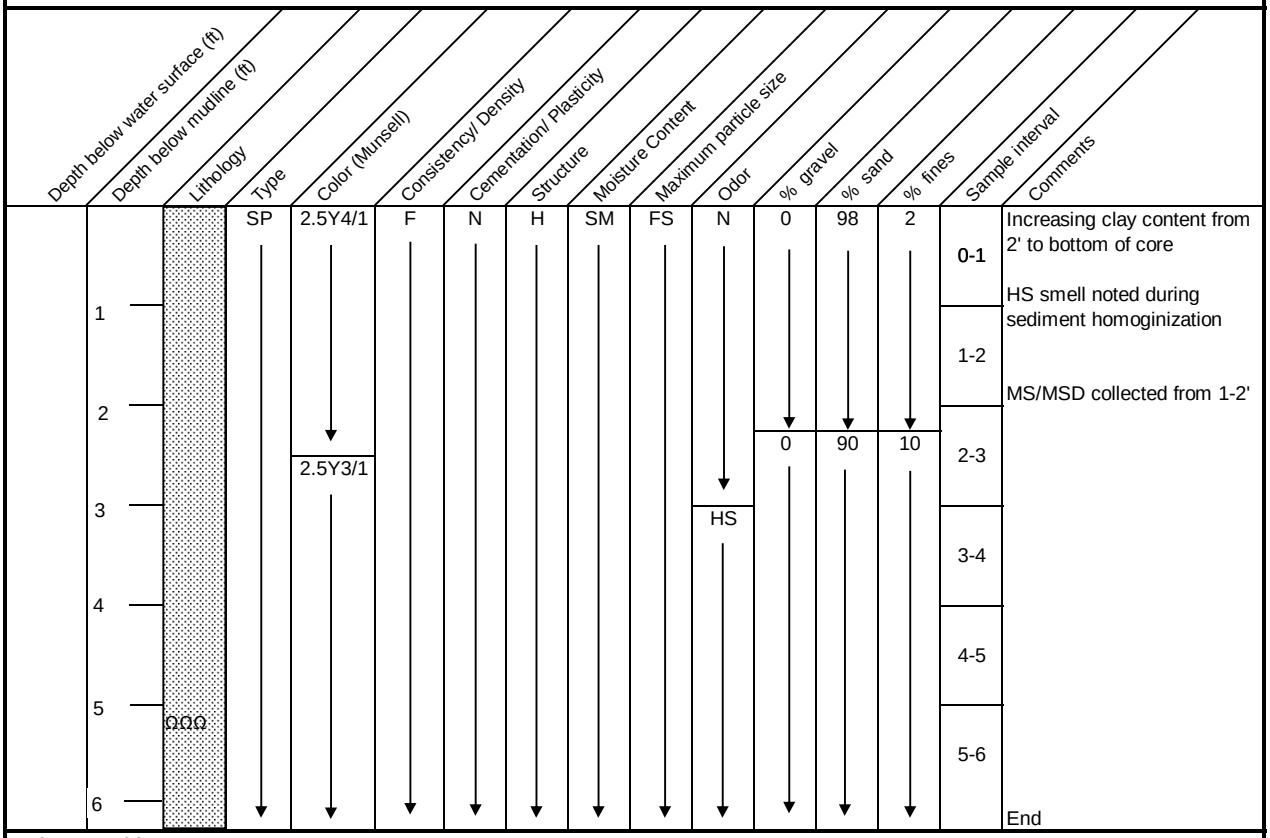
Photo file name	Date	Initials	Subject of Photo
SD07-0-1	**5/21/09**	**TH/RC**	
SD07-1-2	**5/21/09**	**TH/RC**	
SD07-2-3	**5/21/09**	**TH/RC**	
SD07-3-4	**5/21/09**	**TH/RC**	
SD07-4-5	**5/21/09**	**TH/RC**	
SD07-5-6	**5/21/09**	**TH/RC**	

Sample Summary (check boxes for analysis):

Sample ID	Total Metals/Hg/PAHs		TOC		GS		Interval sampled (ft)	Time
STR01-SD07-0-1-0509	**X**		**X**		**X**		**0-1**	**1205**
STR01-SD07-0-1-0509-MS	**X**		**X**				**0-1**	**1205**
STR01-SD07-0-1-0509-SD	**X**		**X**				**0-1**	**1205**
STR01-SD07-1-2-0509	**X**		**X**		**X**		**1-2**	**1205**
STR01-SD07D-1-2-0509	**X**		**X**		**X**		**1-2**	**1205**
STR01-SD07-2-3-0509	**X**		**X**		**X**		**2-3**	**1205**
STR01-SD07-3-4-0509	**X**		**X**		**X**		**3-4**	**1205**
STR01-SD07-4-5-0509	**X**		**X**		**X**		**4-5**	**1205**
STR01-SD07-5-6-0509	**X**		**X**		**X**		**5-6**	**1205**

Site Name: Former Skeet and Trap Range #1
Project Name: Site Inspection for Former Skeet and Trap Range #1
Project Number: 362275
Survey Duration: 5/18/09-5/22/09

Station ID:	STR01-SD08	**Northing:**	443444.04		**Attempt 1**
Sampler(s):	T. Himmer/BOS	**Easting:**	2631733.56	**Penetration (ft):**	7.0'
	R. Clore/CHC	**Datum:**	NC State Plane	**Recovery (ft)**	6.8'
	J. Diner/RDU	**Depth:**	7.8'	**Time:**	1228 5/21/09
Survey Crew:	Catlin	**Tide:**	N/A		**Attempt 2**
		St. Arrival:	1224	**Penetration (ft):**	NA
Vessel:	RV Vibracore 2	**St. Depart**	1241	**Recovery (ft)**	NA
Collection:	Vibracore/pushcore	**Logged by:**	T. Himmer	**Time:**	NA
Weather:	70's clear sunny				



Photographic Log:

Photo file name	Date	Initials	Subject of Photo
SD08-0-1	**5/21/09**	**TH/RC**	
SD08-1-2	**5/21/09**	**TH/RC**	
SD08-2-3	**5/21/09**	**TH/RC**	
SD08-3-4	**5/21/09**	**TH/RC**	
SD08-4-5	**5/21/09**	**TH/RC**	
SD08-5-6	**5/21/09**	**TH/RC**	

Sample Summary (check boxes for analysis):

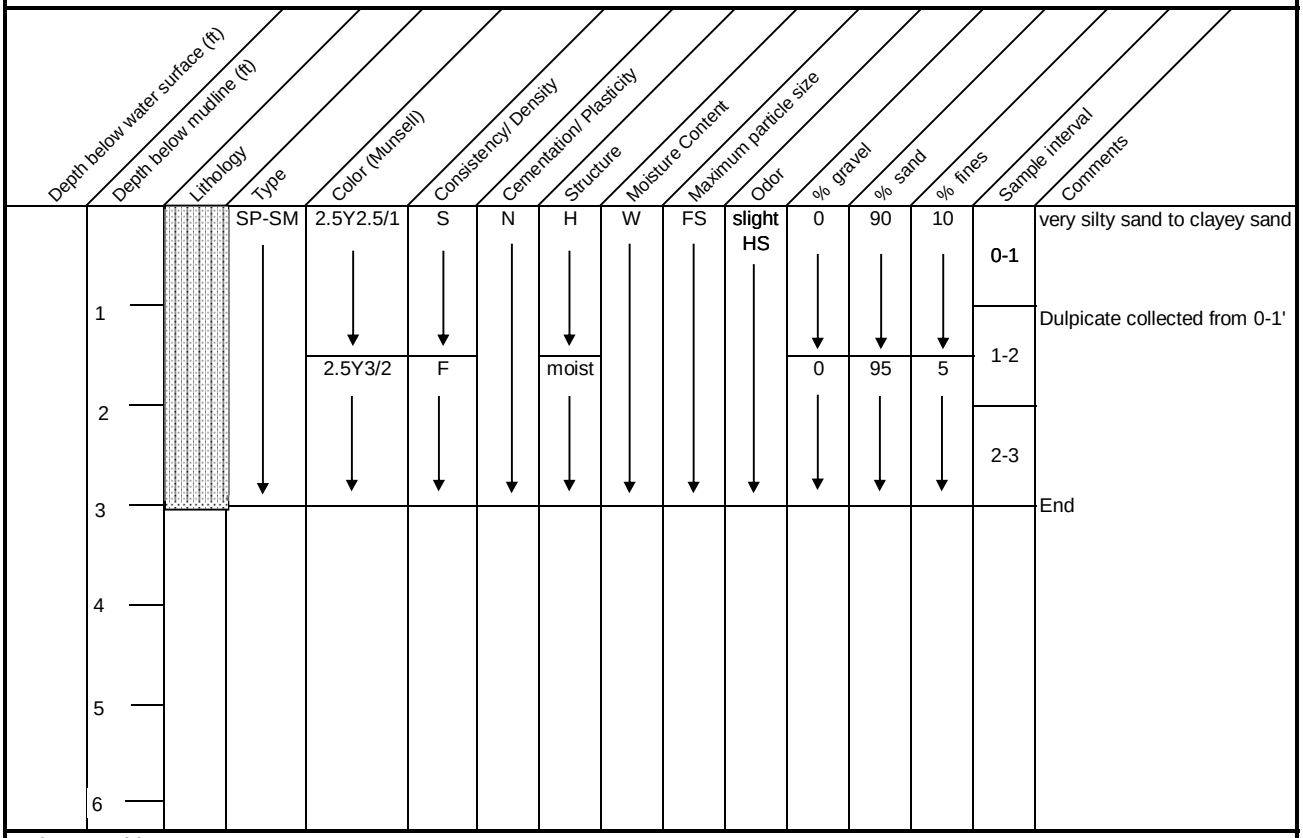
Sample ID	Total Metals/Hg/PAHs	TOC	GS	Interval sampled (ft)	Time
STR01-SD08-0-1-0509	**X**			**0-1**	**1228**
STR01-SD08-1-2-0509	**X**			**1-2**	**1228**
STR01-SD08-1-2-0509-MS	**X**			**1-2**	**1228**
STR01-SD08-1-2-0509-SD	**X**			**1-2**	**1228**
STR01-SD08-2-3-0509	**X**			**2-3**	**1228**
STR01-SD08-3-4-0509	**X**			**3-4**	**1228**
STR01-SD08-4-5-0509	**X**			**4-5**	**1228**
STR01-SD08-5-6-0509	**X**			**5-6**	**1228**

Reviewed by: T. Himmer/BOS Date: 5/25/2009

CH2MHILL

Site Name: Former Skeet and Trap Range #1
Project Name: Site Inspection for Former Skeet and Trap Range #1
Project Number: 362275
Survey Duration: 5/18/09-5/22/09

Station ID:	STR01-SD09	**Northing:**	443699.6		**Attempt 1**
Sampler(s):	T. Himmer/BOS	**Easting:**	2631767.74	**Penetration (ft):**	4.0'
	R. Clore/CHC	**Datum:**	NC State Plane	**Recovery (ft)**	3.0'
	J. Diner/RDU	**Depth:**	7.8'	**Time:**	1250 5/21/09
Survey Crew:	Catlin	**Tide:**	N/A		**Attempt 2**
		St. Arrival:	1247	**Penetration (ft):**	NA
Vessel:	RV Vibracore 2	**St. Depart**	1258	**Recovery (ft)**	NA
Collection:	Vibracore/pushcore	**Logged by:**	T. Himmer	**Time:**	NA
Weather:	70's clear sunny				



Photographic Log:

Photo file name	Date	Initials	Subject of Photo
SD09-0-1	**5/21/09**	**TH/RC**	
SD09-1-2	**5/21/09**	**TH/RC**	
SD09-2-3	**5/21/09**	**TH/RC**	

Sample Summary (check boxes for analysis):

Sample ID	Total Metals/Hg/PAHs	TOC	GS	Interval sampled (ft)	Time
STR01-SD09-0-1-0509	**X**	**X**	**X**	**0-1**	**1250**
STR01-SD09D-0-1-0509	**X**	**X**	**X**	**0-1**	**1250**
STR01-SD09-1-2-0509	**X**	**X**	**X**	**1-2**	**1250**
STR01-SD09-2-3-0509	**X**	**X**	**X**	**2-3**	**1250**

Reviewed by: T. Himmer/BOS Date: 5/25/2009

CH2MHILL

Site Name: Former Skeet and Trap Range #1
Project Name: Site Inspection for Former Skeet and Trap Range #1
Project Number: 362275
Survey Duration: 5/18/09-5/22/09

Station ID:	STR01-SD10	**Northing:**	443170.39		**Attempt 1**
Sampler(s):	T. Himmer/BOS	**Easting:**	2632523.35	**Penetration (ft):**	2.0'
	R. Clore/CHC	**Datum:**	NC State Plane	**Recovery (ft)**	2.0'
	J. Diner/RDU	**Depth:**	4.0'	**Time:**	803 5/21/09
Survey Crew:	Catlin	**Tide:**	N/A		**Attempt 2**
		St. Arrival:	0735	**Penetration (ft):**	2'2"
Vessel:	RV Vibracore 2	**St. Depart**	0845	**Recovery (ft)**	2'2"
Collection:	Vibracore/pushcore	**Logged by:**	R. Clore/J.Diner	**Time:**	835 5/21/09
Weather:	70's clear sunny				

Depth below water surface (ft)	Depth below mudline (ft)	Lithology	Type	Color (Munsell)	Consistency/ Density	Cementation/ Plasticity	Structure	Moisture Content	Maximum particle size	Odor	% gravel	% sand	% fines	Sample interval	Comments
	1		SP	2.5Y3/2	VS	N	H	SM	FS	N	0	100	TR	0-1	Large piece of wood from 1.1 to 1.5' and organics from 1.9 to 2.0"
							S								
	2	λλλ		2.5Y6/1 / 2.5Y2.5/1						HS				1-2	
	3														End
	4														
	5														
	6														

Photographic Log:

Photo file name	Date	Initials	Subject of Photo
SD10-0-1	**5/21/09**	**JD**	
SD10-1-2	**5/21/09**	**JD**	

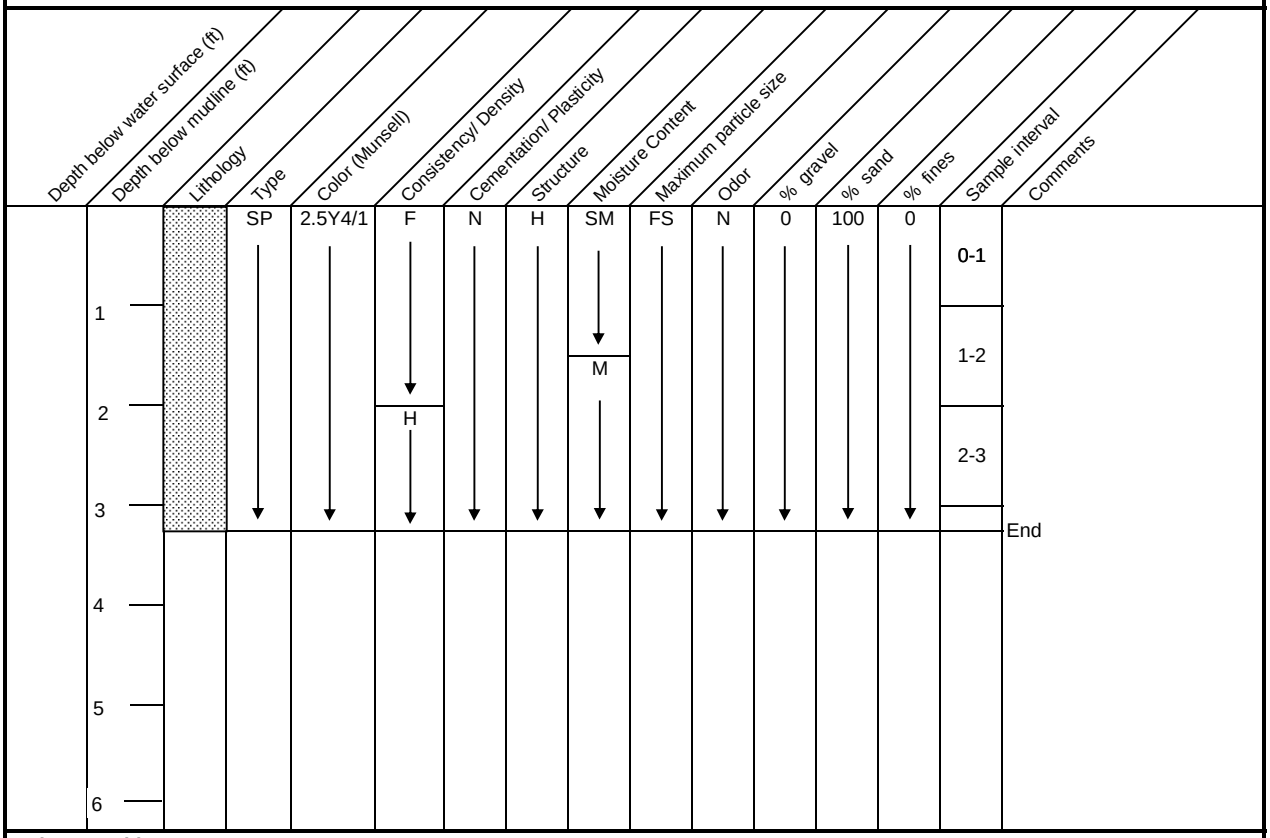
Sample Summary (check boxes for analysis):

Sample ID	Total Metals/Hg/PAHs		TOC		GS		Interval sampled (ft)	Time
STR01-SD10-0-1-0509	**X**						**0-1**	**0803**
STR01-SD10-1-2-0509	**X**						**1-2**	**0803**

Reviewed by: T. Himmer/BOS Date: 5/25/2009

Site Name: Former Skeet and Trap Range #1
Project Name: Site Inspection for Former Skeet and Trap Range #1
Project Number: 362275
Survey Duration: 5/18/09-5/22/09

Station ID:	STR01-SD11	**Northing:**	445394.19		**Attempt 1**
Sampler(s):	T. Himmer/BOS	**Easting:**	2631620.81	**Penetration (ft):**	3.6'
	R. Clore/CHC	**Datum:**	NC State Plane	**Recovery (ft)**	3.3'
	J. Diner/RDU	**Depth:**	4.7'	**Time:**	1342 5/21/09
Survey Crew:	Catlin	**Tide:**	N/A		**Attempt 2**
		St. Arrival:	1330	**Penetration (ft):**	NA
Vessel:	RV Vibracore 2	**St. Depart**	1350	**Recovery (ft)**	NA
Collection:	Vibracore/pushcore	**Logged by:**	T. Himmer	**Time:**	NA
Weather:	70's clear sunny				



Photographic Log:

Photo file name	Date	Initials	Subject of Photo
SD11-0-1	**5/21/09**	**TH/RC**	
SD11-1-2	**5/21/09**	**TH/RC**	
SD11-2-3	**5/21/09**	**TH/RC**	

Sample Summary (check boxes for analysis):

Sample ID	Total Metals/Hg/PAHs	TOC	GS	Interval sampled (ft)	Time
STR01-SD11-0-1-0509	**X**	**X**	**X**	**0-1**	**1342**
STR01-SD11-1-2-0509	**X**	**X**	**X**	**1-2**	**1342**
STR01-SD11-2-3-0509	**X**	**X**	**X**	**2-3**	**1342**

Reviewed by: T. Himmer/BOS Date: 5/25/2009

Site Name: Former Skeet and Trap Range #1
Project Name: Site Inspection for Former Skeet and Trap Range #1
Project Number: 362275
Survey Duration: 5/18/09-5/22/09

Station ID:	STR01-SD12	**Northing:**	444888.02		**Attempt 1**
Sampler(s):	T. Himmer/BOS	**Easting:**	2631196.81	**Penetration (ft):**	3.5'
	R. Clore/CHC	**Datum:**	NC State Plane	**Recovery (ft)**	3.3'
	J. Diner/RDU	**Depth:**	3.6'	**Time:**	1318 5/21/09
Survey Crew:	Catlin	**Tide:**	N/A		**Attempt 2**
		St. Arrival:	1310	**Penetration (ft):**	NA
Vessel:	RV Vibracore 2	**St. Depart**	1323	**Recovery (ft)**	NA
Collection:	Vibracore/pushcore	**Logged by:**	T. Himmer	**Time:**	NA
Weather:	70's clear sunny				

Depth below water surface (ft)	Depth below mudline (ft)	Lithology	Type	Color (Munsell)	Consistency/ Density	Cementation/ Plasticity	Structure	Moisture Content	Maximum particle size	Odor	% gravel	% sand	% fines	Sample interval	Comments
	1	ΩΩΩ	SP	2.5Y4/1	F	N	H	M	FS	N	0	90	10	0-1	Layer of shells from 0.7 to 0.9'
														1-2	
	2								CS	HS	0	15	85		
			CH	2.5Y3/2	S				FS					2-3	very organic rich clay from 2.2' to bottom of core
	3														End
	4														
	5														
	6														

Photographic Log:

Photo file name	Date	Initials	Subject of Photo
SD12-0-1	**5/21/09**	**JD**	
SD12-1-2	**5/21/09**	**JD**	
SD12-2-3	**5/21/09**	**JD**	

Sample Summary (check boxes for analysis):

Sample ID	Total Metals/Hg/PAHs		TOC		GS		Interval sampled (ft)	Time
STR01-SD12-0-1-0509	**X**		**X**		**X**		**0-1**	**1318**
STR01-SD12-1-2-0509	**X**		**X**		**X**		**1-2**	**1318**
STR01-SD12-2-3-0509	**X**		**X**		**X**		**2-3**	**1318**

Reviewed by: T. Himmer/BOS Date: 5/25/2009

Site Name: Former Skeet and Trap Range #1
Project Name: Expanded Site Inspection for Former Skeet and Trap Range #1
Project Number: 380729
Survey Duration: 2/7/2012-2/8/2012

Station ID:	STR01-SD13	**Northing:**	446492.191		**Attempt 1**
Sampler(s):	T. Himmer/BOS	**Easting:**	2629652.623	**Penetration (ft):**	2.5'
	J.High/CLT	**Datum:**	NC State Plane	**Recovery (ft)**	2.3'
		Depth:	13'	**Time:**	11:10
Survey Crew:	Catlin - Miller, Mason,	**Tide:**			**Attempt 2**
	and O'Neill	**St. Arrival:**	2/7/12 10:40 AM	**Penetration (ft):**	NA
Vessel:	RV Vibracore 2	**St. Depart**	2/7/12 11:15 AM	**Recovery (ft)**	NA
Collection:	Vibracore/pushcore	**Logged by:**	T.Himmer/BOS	**Time:**	NA
Weather:	clear, calm				

Depth below water surface (ft)	Depth below mudline (ft)	Lithology	Type	Color (Munsell)	Consistency/ Density	Cementation/ Plasticity	Structure	Moisture Content	Maximum particle size	Odor	% gravel	% sand	% fines	Sample interval	Comments
	1		SP	10YR 7/3	H	N	H	SM	VFS	N	0	99	1	0-1	0-11" clean light brown sand 11-15" dark gray to black sand w/ shell hash at 13-14" and coarse sand from 14-15" 15" to BOC - thick, plastic clay with shell hash from 25-28"
			SP-SW	10YR 3/1		plastic		D	MS			95	5		
	2		CL						CS			95	5		
	BOC= 2'4"	QQQ	CL						Z			0	100		
	3														
	4														
	5														
	6														

Photographic Log:

Photo file name	Date	Initials	Subject of Photo
SD13_1	**2/8/12**	**TMH**	**Core SD13**
SD13_2	**2/8/12**	**TMH**	**Core SD13**
SD13_3	**2/8/12**	**TMH**	**Core SD13**

Sample Summary (check boxes for analysis):

Sample ID	PAH	TOC	GS	Interval sampled (ft)	Time
STR01-SD13-0-1-0212	**X**	**X**	**X**	**0-1**	**11:10**
STR01-SD13D-0-1-0212	**X**			**0-1**	**11:10**

Reviewed by: T. Himmer/BOS Date: 2/8/2012

CH2MHILL

Site Name: Former Skeet and Trap Range #1
Project Name: Expanded Site Inspection for Former Skeet and Trap Range #1
Project Number: 380729
Survey Duration: 2/7/2012-2/8/2012

Station ID:	STR01-SD14	**Northing:**	445883.558		**Attempt 1**
Sampler(s):	T. Himmer/BOS	**Easting:**	2630672.099	**Penetration (ft):**	3'
	J.High/CLT	**Datum:**	NC State Plane	**Recovery (ft)**	2.9'
		Depth:	2.7'	**Time:**	11:45
Survey Crew:	Catlin - Miller, Mason,	**Tide:**			**Attempt 2**
	and O'Neill	**St. Arrival:**	2/7/12 11:30 AM	**Penetration (ft):**	NA
Vessel:	RV Vibracore 2	**St. Depart**	2/7/12 11:50 AM	**Recovery (ft)**	NA
Collection:	Pushcore	**Logged by:**	T.Himmer/BOS	**Time:**	NA
Weather:	clear, calm				

Depth below water surface (ft)	Depth below mudline (ft)	Lithology	Type	Color (Munsell)	Consistency/ Density	Cementation/ Plasticity	Structure	Moisture Content	Maximum particle size	Odor	% gravel	% sand	% fines	Sample interval	Comments
	1		SP	10YR 7/3	H	N	H	M	FS	N	0	99	1	0-1	0-1' sand; top 0-1" fine to very fine, clean, light brown.
			↓	10YR		↓		↓	MS			95	5		1-10" fine sand, some medium sand, dark gray
			SW	5/1											10-13" - medium-coarse sand, dark gray, poorly sorted
	2		CL			plastic		D	CS			95	5		13-20" very hard, plastic, dark gray clay, fat
				10YR 3/1					Z			0	100		20" to BOC - clay, plastic, with shell hash, light gray to gray
	BOC= 2'10"		CL w/ shell hash												
	3														
	4														
	5														
	6														

Photographic Log:

Photo file name	Date	Initials	Subject of Photo
SD14_1	**2/8/12**	**TMH**	**Core SD14**
SD14_2	**2/8/12**	**TMH**	**Core SD14**
SD14_3	**2/8/12**	**TMH**	**Core SD14**

Sample Summary (check boxes for analysis):

Sample ID	PAH	TOC	GS	Interval sampled (ft)	Time
STR01-SD14-0-1-0212	**X**	**X**	**X**	**0-1**	**11:45**
STR01-SD14-0-1-0212-MS	**X**			**0-1**	**11:45**
STR01-SD14-0-1-0212-SD	**X**			**0-1**	**11:45**

Reviewed by: T. Himmer/BOS Date: 2/8/2012

CH2MHILL

Site Name: Former Skeet and Trap Range #1
Project Name: Expanded Site Inspection for Former Skeet and Trap Range #1
Project Number: 380729
Survey Duration: 2/7/2012-2/8/2012

Station ID:	STR01-SD15	**Northing:**	444908.075		**Attempt 1**
Sampler(s):	T. Himmer/BOS	**Easting:**	2631153.597	**Penetration (ft):**	3'
	J.High/CLT	**Datum:**	NC State Plane	**Recovery (ft)**	2.7'
		Depth:	2.8'	**Time:**	12:15
Survey Crew:	Catlin - Miller, Mason,	**Tide:**			**Attempt 2**
	and O'Neill	**St. Arrival:**	2/7/12 12:05 PM	**Penetration (ft):**	NA
Vessel:	RV Vibracore 2	**St. Depart**	2/7/12 12:20 PM	**Recovery (ft)**	NA
Collection:	Vibracore/pushcore	**Logged by:**	T.Himmer/BOS	**Time:**	NA
Weather:	clear, calm				

Depth below water surface (ft)	Depth below mudline (ft)	Lithology	Type	Color (Munsell)	Consistency/ Density	Cementation/ Plasticity	Structure	Moisture Content	Maximum particle size	Odor	% gravel	% sand	% fines	Sample interval	Comments
1 BOC= 1'9"		ΩΩΩ	SP	10YR 3/1 10YR 5/2	H	N	H	M D	FS MS	N	0	95 99	5 1	0-1	Entire core fine to fine to medium sand with minor fines in the top 4". Trace fines from 4" to BOC. Shell hash from 6-9". Well-sorted (poorly graded) sand.
2															
3															
4															
5															
6															

Photographic Log:

Photo file name	Date	Initials	Subject of Photo
SD15_1	**2/8/12**	**TMH**	**Core SD15**
SD15_2	**2/8/12**	**TMH**	**Core SD15**
SD15_3	**2/8/12**	**TMH**	**Core SD15**

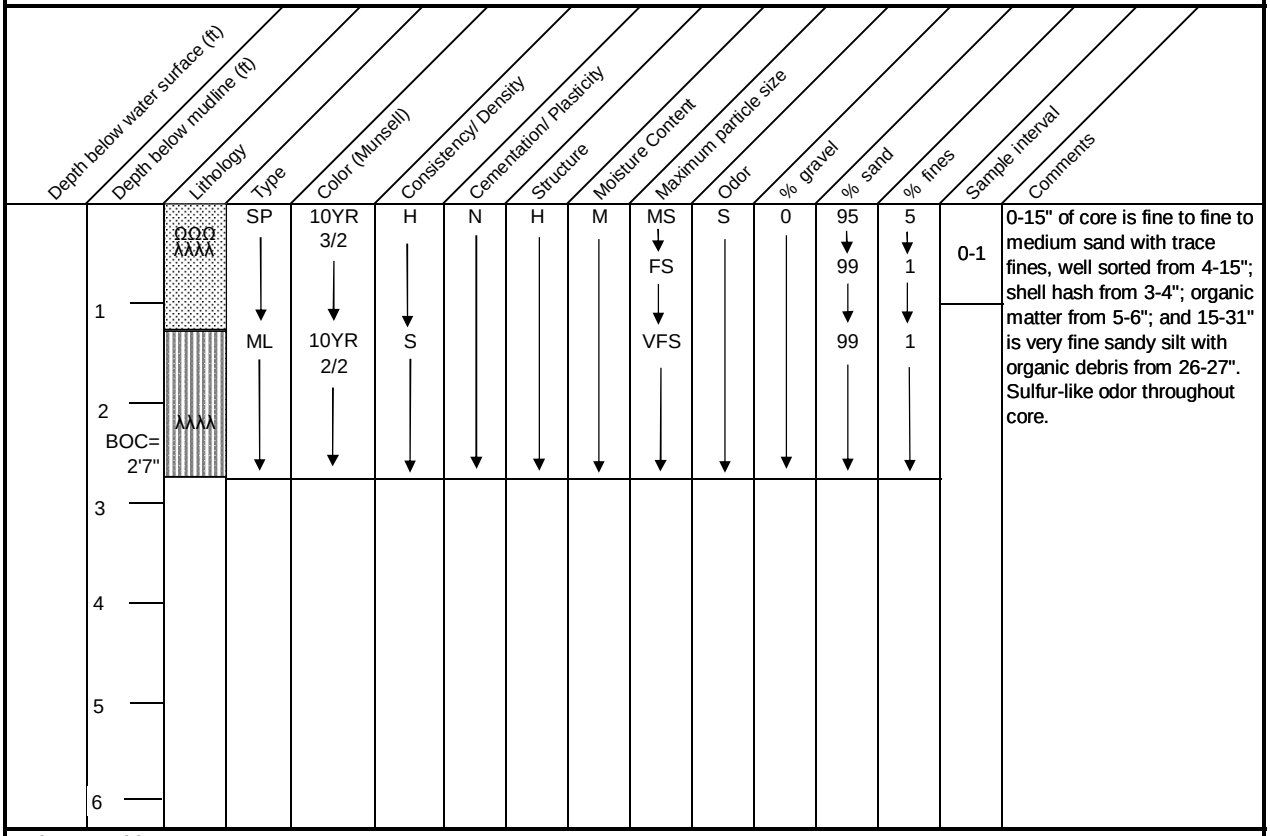
Sample Summary (check boxes for analysis):

Sample ID	PAH	TOC	GS	Interval sampled (ft)	Time
STR01-SD15-0-1-0212	**X**	**X**	**X**	**0-1**	**12:15**

Reviewed by: T. Himmer/BOS Date: 2/8/2012

Site Name: Former Skeet and Trap Range #1
Project Name: Expanded Site Inspection for Former Skeet and Trap Range #1
Project Number: 380729
Survey Duration: 2/7/2012-2/8/2012

Station ID:	STR01-SD16	**Northing:**	444829.085		**Attempt 1**
Sampler(s):	T. Himmer/BOS	**Easting:**	2629587.925	**Penetration (ft):**	3.0'
	J.High/CLT	**Datum:**	NC State Plane	**Recovery (ft)**	2.5'
		Depth:	2.5'	**Time:**	8:30
Survey Crew:	Catlin - Miller, Mason,	**Tide:**			**Attempt 2**
	and O'Neill	**St. Arrival:**	2/7/12 8:20 AM	**Penetration (ft):**	3.0'
Vessel:	RV Vibracore 2	**St. Depart**	2/7/12 8:55 AM	**Recovery (ft)**	2.7'
Collection:	Vibracore/pushcore	**Logged by:**	J.High/CLT	**Time:**	8:45
Weather:	clear, calm			Collected duplicate core for QC; later discarded.	



Photographic Log:

Photo file name	Date	Initials	Subject of Photo
SD16_1	**2/8/12**	**JMH**	**Core SD16**
SD16_2	**2/8/12**	**JMH**	**Core SD16**
SD16_3	**2/8/12**	**JMH**	**Core SD16**

Sample Summary (check boxes for analysis):

Sample ID	PAH	TOC	GS	Interval sampled (ft)	Time
STR01-SD16-0-1-0212	**X**	**X**	**X**	**0-1**	**8:30**

Reviewed by: T. Himmer/BOS Date: 2/8/2012

CH2MHILL

Site Name: Former Skeet and Trap Range #1
Project Name: Expanded Site Inspection for Former Skeet and Trap Range #1
Project Number: 380729
Survey Duration: 2/7/2012-2/8/2012

Station ID:	STR01-SD17	**Northing:**	444452.487		**Attempt 1**
Sampler(s):	T. Himmer/BOS	**Easting:**	2630267.896	**Penetration (ft):**	3.5'
	J.High/CLT	**Datum:**	NC State Plane	**Recovery (ft)**	2.8'
		Depth:	13.5'	**Time:**	9:50
Survey Crew:	Catlin - Miller, Mason,	**Tide:**			**Attempt 2**
	and O'Neill	**St. Arrival:**	2/7/12 9:25 AM	**Penetration (ft):**	NA
Vessel:	RV Vibracore 2	**St. Depart**	2/7/12 10:05 AM	**Recovery (ft)**	NA
Collection:	pushcore	**Logged by:**	J.High/CLT	**Time:**	NA
Weather:	clear, calm				

Depth below water surface (ft)	Depth below mudline (ft)	Lithology	Type	Color (Munsell)	Consistency/ Density	Cementation/ Plasticity	Structure	Moisture Content	Maximum particle size	Odor	% gravel	% sand	% fines	Sample interval	Comments
	1	ΩΩΩ	CL	10YR 3/2	H	plastic	H	D	Z MS	N	0	95	5	0-1	0-10" clay, dark brown, plastic, with sand lenses (moist, medium-fine, black sand). 7-9" with shell hash 10-32" clay, dark brown, hard plastic.
	2	BOC= 2'8.5"										99	1		
	3														
	4														
	5														
	6														

Photographic Log:

Photo file name	Date	Initials	Subject of Photo
SD17_1	**2/8/12**	**JMH**	**Core SD17**
SD17_2	**2/8/12**	**JMH**	**Core SD17**
SD17_3	**2/8/12**	**JMH**	**Core SD17**

Sample Summary (check boxes for analysis):

Sample ID	PAH	TOC	GS	Interval sampled (ft)	Time
STR01-SD17-0-1-0212	**X**	**X**	**X**	**0-1**	**9:50**

Reviewed by: T. Himmer/BOS Date: 2/8/2012

CH2MHILL

Site Name: Former Skeet and Trap Range #1
Project Name: Expanded Site Inspection for Former Skeet and Trap Range #1
Project Number: 380729
Survey Duration: 2/7/2012-2/8/2012

Station ID:	STR01-SD18	**Northing:**	443725.694		**Attempt 1**
Sampler(s):	T. Himmer/BOS	**Easting:**	2630715.309	**Penetration (ft):**	3.1'
	J.High/CLT	**Datum:**	NC State Plane	**Recovery (ft)**	2.7'
		Depth:	2.2'	**Time:**	14:20
Survey Crew:	Catlin - Miller, Mason,	**Tide:**			**Attempt 2**
	and O'Neill	**St. Arrival:**	2/7/2012 14:15 PM	**Penetration (ft):**	NA
Vessel:	RV Vibracore 2	**St. Depart**	2/7/2012 14:30 PM	**Recovery (ft)**	NA
Collection:	Vibracore/pushcore	**Logged by:**	J.High/CLT	**Time:**	NA
Weather:	clear, calm				

Depth below water surface (ft)	Depth below mudline (ft)	Lithology	Type	Color (Munsell)	Consistency/ Density	Cementation/ Plasticity	Structure	Moisture Content	Maximum particle size	Odor	% gravel	% sand	% fines	Sample interval	Comments
	1	ΩΩΩ	SP	10YR 6/2 10YR 5/2	H	N	H	D	FS MS	N	0	95	5	0-1	Entire core , 0-25" is sand (SP), light to gray brown, shell hash from 5.5 to 7", dry, fine to medium-fine sands, poorly graded
	2														
	BOC= 2'1"														
	3														
	4														
	5														
	6														

Photographic Log:

Photo file name	Date	Initials	Subject of Photo
SD18_1	**2/8/12**	**JMH**	**Core SD18**
SD18_2	**2/8/12**	**JMH**	**Core SD18**
SD18_3	**2/8/12**	**JMH**	**Core SD18**

Sample Summary (check boxes for analysis):

Sample ID	PAH	TOC	GS	Interval sampled (ft)	Time
STR01-SD18-0-1-0212	**X**	**X**	**X**	**0-1**	**14:20**

Reviewed by: T. Himmer/BOS Date: 2/8/2012

Site Name: Former Skeet and Trap Range #1
Project Name: Expanded Site Inspection for Former Skeet and Trap Range #1
Project Number: 380729
Survey Duration: 2/7/2012-2/8/2012

Station ID:	STR01-SD19	**Northing:**	444343.163		**Attempt 1**
Sampler(s):	T. Himmer/BOS	**Easting:**	2632115.802	**Penetration (ft):**	3.5'
	J.High/CLT	**Datum:**	NC State Plane	**Recovery (ft)**	1.7'
		Depth:	5.3'	**Time:**	12:50
Survey Crew:	Catlin - Miller, Mason,	**Tide:**			**Attempt 2**
	and O'Neill	**St. Arrival:**	2/7/12 12:42 PM	**Penetration (ft):**	NA
Vessel:	RV Vibracore 2	**St. Depart**	2/7/12 13:10 PM	**Recovery (ft)**	NA
Collection:	pushcore	**Logged by:**	J.High/CLT	**Time:**	NA
Weather:	clear, calm				

Depth below water surface (ft)	Depth below mudline (ft)	Lithology	Type	Color (Munsell)	Consistency/ Density	Cementation/ Plasticity	Structure	Moisture Content	Maximum particle size	Odor	% gravel	% sand	% fines	Sample interval	Comments
	1 BOC= 1' 8.3"	ΩΩΩ	SP	10YR 3/2	H	N	H	M	VFS-FS	N	0	99	1	0-1	Entire core, 0-20.25" is poorly graded, fine to very fine, moist sand, shell hash from 15.5-17"
	2														
	3														
	4														
	5														
	6														

Photographic Log:

Photo file name	Date	Initials	Subject of Photo
SD19_1	**2/8/12**	**JMH**	**Core SD19**
SD19_2	**2/8/12**	**JMH**	**Core SD19**

Sample Summary (check boxes for analysis):

Sample ID	PAH	TOC	GS	Interval sampled (ft)	Time
STR01-SD19-0-1-0212	**X**	**X**	**X**	**0-1**	**12:50**

Reviewed by: T. Himmer/BOS Date: 2/8/2012

Site Name: Former Skeet and Trap Range #1
Project Name: Expanded Site Inspection for Former Skeet and Trap Range #1
Project Number: 380729
Survey Duration: 2/7/2012-2/8/2012

Station ID:	STR01-SD20	**Northing:**	443270.249		**Attempt 1**
Sampler(s):	T. Himmer/BOS	**Easting:**	2631385.047	**Penetration (ft):**	3'
	J.High/CLT	**Datum:**	NC State Plane	**Recovery (ft)**	2.3'
		Depth:	2.1'	**Time:**	14:50
Survey Crew:	Catlin - Miller, Mason,	**Tide:**			**Attempt 2**
	and O'Neill	**St. Arrival:**	2/7/2012 14:45 PM	**Penetration (ft):**	NA
Vessel:	RV Vibracore 2	**St. Depart**	2/7/2012 15:00 PM	**Recovery (ft)**	NA
Collection:	pushcore/vibracore	**Logged by:**	J.High/CLT	**Time:**	NA
Weather:	clear, calm				

Depth below water surface (ft)	Depth below mudline (ft)	Lithology	Type	Color (Munsell)	Consistency/ Density	Cementation/ Plasticity	Structure	Moisture Content	Maximum particle size	Odor	% gravel	% sand	% fines	Sample interval	Comments
	1		SP	10YR 6/3	H	N	H	D	FS-MS	N	0	99	1	0-1	Entire core, 0-27.5", sand, fine to very fine, poorly graded, light tan/brown from 0-10", light gray-brown 10-22" and light to medium brown from 22-27.5"; dry
	2			6/1											
	BOC= 2'3.5"			4/2											
	3														
	4														
	5														
	6														

Photographic Log:

Photo file name	Date	Initials	Subject of Photo
SD20_1	**2/8/12**	**JMH**	**Core SD20**
SD20_2	**2/8/12**	**JMH**	**Core SD20**
SD20_3	**2/8/12**	**JMH**	**Core SD20**

Sample Summary (check boxes for analysis):

Sample ID	PAH	TOC	GS	Interval sampled (ft)	Time
STR01-SD20-0-1-0212	**X**	**X**	**X**	**0-1**	**14:50**

Reviewed by: T. Himmer/BOS Date: 2/8/2012

CH2MHILL

Site Name: Former Skeet and Trap Range #1
Project Name: Expanded Site Inspection for Former Skeet and Trap Range #1
Project Number: 380729
Survey Duration: 2/7/2012-2/8/2012

Station ID:	STR01-SD21	**Northing:**	443188.152		**Attempt 1**
Sampler(s):	T. Himmer/BOS	**Easting:**	2631571.332	**Penetration (ft):**	3'
	J.High/CLT	**Datum:**	NC State Plane	**Recovery (ft)**	2.3'
		Depth:	2.2'	**Time:**	15:35
Survey Crew:	Catlin - Miller, Mason,	**Tide:**			**Attempt 2**
	and O'Neill	**St. Arrival:**	2/7/2012 15:25 PM	**Penetration (ft):**	NA
Vessel:	RV Vibracore 2	**St. Depart**	2/7/2012 15:45 PM	**Recovery (ft)**	NA
Collection:	pushcore/vibracore	**Logged by:**	J.High/CLT	**Time:**	NA
Weather:	clear, calm				

Depth below water surface (ft)	Depth below mudline (ft)	Lithology	Type	Color (Munsell)	Consistency/ Density	Cementation/ Plasticity	Structure	Moisture Content	Maximum particle size	Odor	% gravel	% sand	% fines	Sample interval	Comments
	1	ΩΩΩ	SP	10YR 5/3	H	N	H	D	F-VF	N	0	99	1	0-1	0-8.5" fine to very fine sand, light tan brown, dry, poorly graded. Shell hash from 7 to 8.5".
		ΩΩΩ		5/1											8.5-10.5" very fine sand, light gray, dry, poorly graded (well sorted).
	2	ΩΩΩ		3/1					CS			90	10		10.5-23" very find sands, light gray, dry, well sorted, wood fragments at 14.5-15"; shell hash at 18.5-19.5"
	BOC= 2'4"	ΩΩΩ													23-28" coarse sands, poorly graded, medium to dark brown with shell hash throughout.
	3														
	4														
	5														
	6														

Photographic Log:

Photo file name	Date	Initials	Subject of Photo
SD21_1	**2/8/12**	**JMH**	**Core SD21**
SD21_2	**2/8/12**	**JMH**	**Core SD21**
SD21_3	**2/8/12**	**JMH**	**Core SD21**

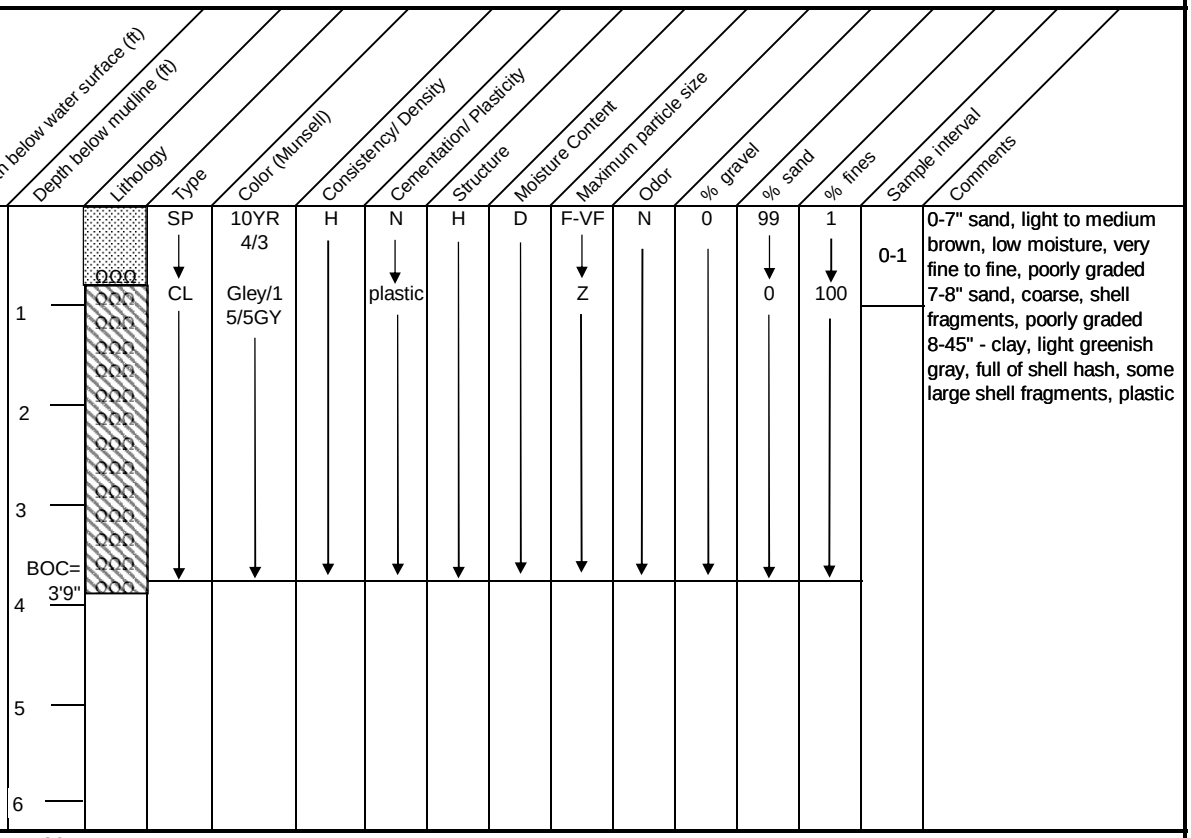
Sample Summary (check boxes for analysis):

Sample ID	PAH	TOC	GS	Interval sampled (ft)	Time
STR01-SD21-0-1-0212	**X**	**X**	**X**	**0-1**	**15:35**

Reviewed by: T. Himmer/BOS Date: 2/8/2012

Site Name: Former Skeet and Trap Range #1
Project Name: Expanded Site Inspection for Former Skeet and Trap Range #1
Project Number: 380729
Survey Duration: 2/7/2012-2/8/2012

Station ID:	STR01-SD22	**Northing:**	443038.404		**Attempt 1**
Sampler(s):	T. Himmer/BOS	**Easting:**	2632037.318	**Penetration (ft):**	4.2'
	J.High/CLT	**Datum:**	NC State Plane	**Recovery (ft)**	3.9'
		Depth:	2.2'	**Time:**	16:00
Survey Crew:	Catlin - Miller, Mason,	**Tide:**			**Attempt 2**
	and O'Neill	**St. Arrival:**	2/7/2012 15:50 PM	**Penetration (ft):**	NA
Vessel:	RV Vibracore 2	**St. Depart**	2/7/2012 16:15 PM	**Recovery (ft)**	NA
Collection:	pushcore/vibracore	**Logged by:**	J.High/CLT	**Time:**	NA
Weather:	clear, calm				



Photographic Log:

Photo file name	Date	Initials	Subject of Photo
SD22_1	**2/8/12**	**JMH**	**Core SD22**
SD22_2	**2/8/12**	**JMH**	**Core SD22**
SD22_3	**2/8/12**	**JMH**	**Core SD22**

Sample Summary (check boxes for analysis):

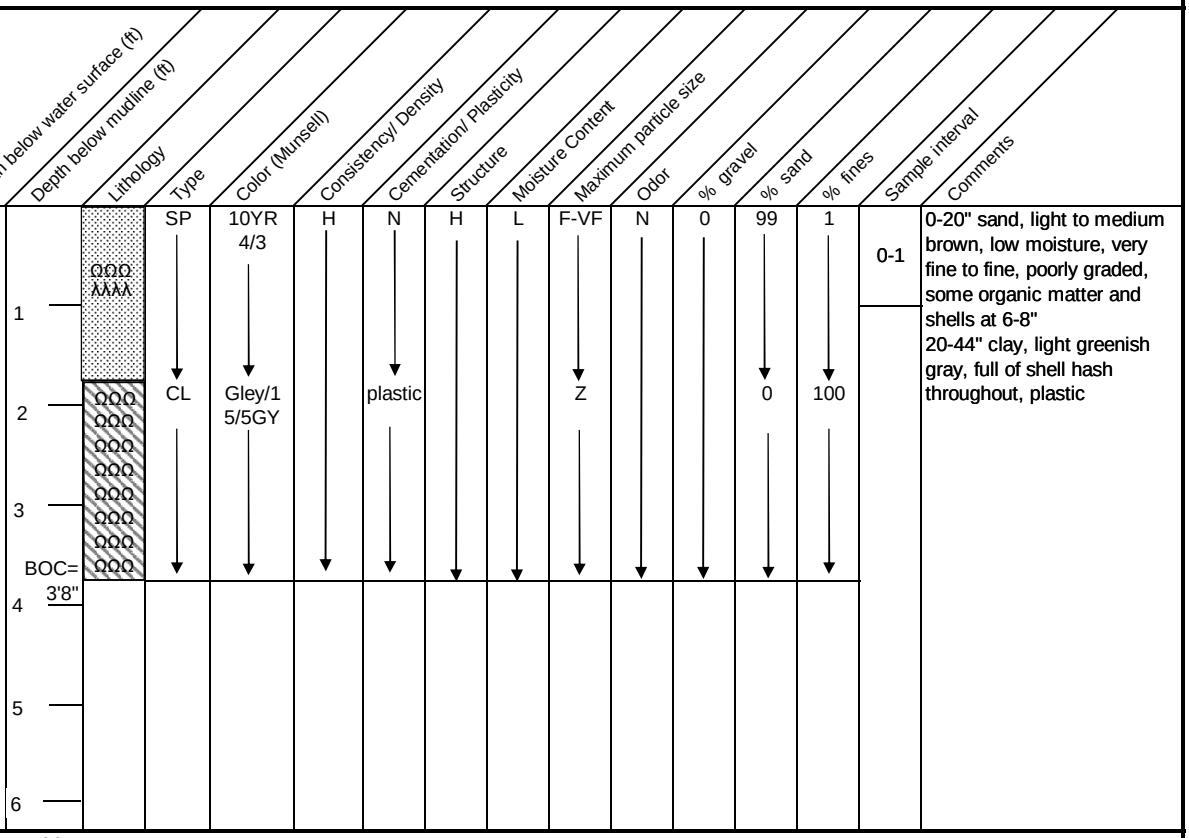
Sample ID	PAH	TOC	GS	Interval sampled (ft)	Time
STR01-SD22-0-1-0212	**X**	**X**	**X**	**0-1**	**16:00**

Reviewed by: T. Himmer/BOS Date: 2/8/2012

CH2MHILL

Site Name: Former Skeet and Trap Range #1
Project Name: Expanded Site Inspection for Former Skeet and Trap Range #1
Project Number: 380729
Survey Duration: 2/7/2012-2/8/2012

Station ID:	STR01-SD23	**Northing:**	443124.059		**Attempt 1**
Sampler(s):	T. Himmer/BOS	**Easting:**	2633711.175	**Penetration (ft):**	3.5'
	J.High/CLT	**Datum:**	NC State Plane	**Recovery (ft)**	3.3'
		Depth:	3.5'	**Time:**	wash out
Survey Crew:	Catlin - Miller, Mason,	**Tide:**			**Attempt 2**
	and O'Neill	**St. Arrival:**	2/7/2012 13:30 PM	**Penetration (ft):**	4'
Vessel:	RV Vibracore 2	**St. Depart**	2/7/2012 14:00 PM	**Recovery (ft)**	3.6'
Collection:	pushcore/vibracore	**Logged by:**	J.High/CLT	**Time:**	13:50
Weather:	clear, calm				attempt #2 retained



0-20" sand, light to medium brown, low moisture, very fine to fine, poorly graded, some organic matter and shells at 6-8"
20-44" clay, light greenish gray, full of shell hash throughout, plastic

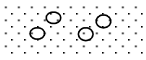
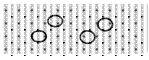
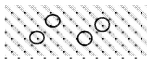
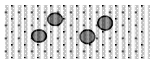
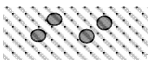
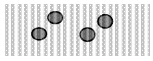
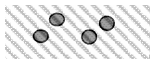
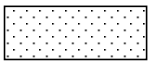
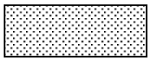
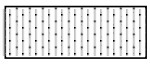
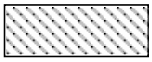
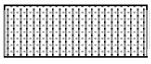
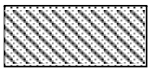
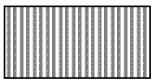
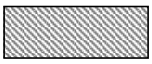
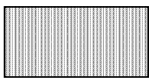
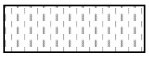
Photographic Log:

Photo file name	Date	Initials	Subject of Photo
SD23_1	**2/8/12**	**JMH**	**Core SD23**
SD23_2	**2/8/12**	**JMH**	**Core SD23**
SD23_3	**2/8/12**	**JMH**	**Core SD23**

Sample Summary (check boxes for analysis):

Sample ID	PAH	TOC	GS	Interval sampled (ft)	Time
STR01-SD23-0-1-0212	**X**	**X**	**X**	**0-1**	**13:50**
STR01-SD23D-0-1-0212	**X**				

Reviewed by: T. Himmer/BOS Date: 2/8/2012

MAJOR DIVISIONS		GRAPHIC SYMBOL	GROUP SYMBOL	DESCRIPTION
COARSE-GRAINED MATERIAL	GRAVELS — CLEAN GRAVELS		GW	Well-graded gravel Well-graded gravel with sand
			GP	Poorly graded gravel Poorly graded gravel with sand
	GRAVELS WITH FINES		GW-GM	Well-graded gravel with silt Well-graded gravel with silt and sand
			GW-GC	Well-graded gravel with clay Well graded gravel with clay and sand
			GP-GM	Poorly graded gravel with silt Poorly graded gravel with silt and sand
			GP-GC	Poorly graded gravel with clay Poorly graded gravel with clay and sand
			GM	Silty gravel Silty gravel with sand
			GC	Clayey gravel Clayey gravel with sand
	SANDS — CLEAN SANDS		SW	Well-graded sands Well-graded sand and gravel
			SP	Poorly-graded sands Poorly graded sand with gravel
	SANDS WITH FINES		SW-SM	Well-graded sand with silt Well-graded sand with silt and gravel
			SW-SC	Well-graded sand with clay Well-graded sand with clay and gravel
			SP-SM	Poorly-graded sand with silt Poorly-graded sand with silt and gravel
			SP-SC	Poorly-graded sand with clay Poorly-graded sand with clay and gravel
			SM	Silty sand Silty sand and with gravel
			SC	Clayey sand Clayey sand and with gravel
FINE-GRAINED MATERIALS	SILTS AND CLAYS		CL	Lean clay * Lean clay with sand or gravel * Sandy lean clay * Sandy lean clay with gravel * Gravelly lean clay * Gravelly lean clay with sand
			ML	Silt * Silty with sand or gravel * Sandy silt * Sandy silt with gravel * Gravelly silt * Gravelly silt with sand
			CH	Fat clay * Fat clay with sand or gravel * Sandy fat clay * Gravelly fat clay * Gravelly fat clay with sand
			MH	Elastic silt * Elastic silt with sand or gravel * Sandy elastic silt * Sandy elastic silt with gravel * Gravelly elastic silt * Gravelly elastic silt with sand
			OL/OH	Organic silt * Organic silt with sand or gravel * Sandy organic silt * Sandy organic soil with gravel * Gravelly organic soil * Gravelly organic soil with sand

Ω Shell hash

λλλλ Peat/organic matter

CONSISTENCY

Penetration of thumb:
<0.25 cm = hard (H)
0.25 - 2.0 cm = firm (F)
2.0 - 4.0 cm = soft (S)
>4.0 cm = very soft (VS)

CEMENTION

N = not cemented
W = weakly cemented
M = Moderately cemented
S = Strongly cemented

STRUCTURE

H = Homogeneous
S = Stratified
L = Laminated
M = Mottled

HCl REACTION

N = None
W = Weak
S = Strong

MAXIMUM PARTICLE SIZE

SC = Small Cobble
CP = Coarse Pebble
MP = Medium Pebble
SP = Small Pebble
CS = Coarse Sand
MS = Medium Sand
FS = Fine Sand
VFS = Very Fine Sand
Z = Silt

SA = Sub-angular
VA = Very angular

ODOR

N = None
H = Hydrocarbon
S or HS =Sulfide

COLOR

from munsell chart

DILATANCY

N = None
S = Slow
R = Rapid

TOUGHNESS

L = Low
M = Medium
H = High

MOISTURE CONTENT

W = wet
M = moist
SM = slightly moist
D = dry

Appendix C
Investigation-Derived Waste Documentation

ANALYTICAL SUMMARY DATA PACKAGE
SDG # 1202065

PROJECT NAME: MCAS Cherry Point CTO026
PROJECT LOCATION: Havelock, NC

SUBMITTAL TO:
Juan Acaron
CH2M Hill, Inc.
3011 S.W. Williston Road
Gainesville, FL 32608

SUBMITTAL BY:
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621 Mainstream Drive, Suite 270
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Email: sgordon@empirlabs.com

Original Report Date: March 7, 2012
Report Revision #: N/A
Revision Date: N/A
Total # of Pages: 195

THIS DOCUMENT MEETS DoD QSM 4.2 STANDARDS

The results relate to only the samples associated with the referenced SDG and the submitted data has been produced in accordance with laboratory procedures. The Laboratory's Technical Lab Director, Mr. Rick Davis, is responsible for the final data produced and reported. His signature is listed at the end of the Case Narrative within the Analytical Data Package. If applicable to this report package, details on report revisions and the information on subcontracted analysis are listed in the package Case Narrative. This report shall not be reproduced, except in full, without the written approval of Empirical Laboratories, LLC.

ANALYSIS DATA SHEET

STR1-IDW-02082012

Laboratory: Empirical Laboratories, LLC SDG: 1202065

Client: CH2M Hill, Inc. Project: MCAS Cherry Point CTO 026

Matrix: Solid Laboratory ID: 1202065-01 File ID: 0206501T.D

Sampled: 02/08/12 13:15 Prepared: 02/17/12 00:00 Analyzed: 02/17/12 17:53

Solids: Preparation: 5030B Dilution: 10

Batch: 2B17019 Sequence: 2B05103 Calibration: 2026003 Instrument: MS-VOA3

CAS NO.	COMPOUND	CONC. (mg/L)	TCLP Reg Limit	LOD	LOQ	Q
71-43-2	Benzene		0.5	0.00500	0.0100	U
78-93-3	2-Butanone		200	0.0500	0.100	U
56-23-5	Carbon tetrachloride		0.5	0.00500	0.0100	U
108-90-7	Chlorobenzene		100	0.00500	0.0100	U
67-66-3	Chloroform		6	0.00500	0.0100	U
106-46-7	1,4-Dichlorobenzene		7.5	0.00500	0.0100	U
107-06-2	1,2-Dichloroethane		0.5	0.00500	0.0100	U
75-35-4	1,1-Dichloroethene		0.7	0.00500	0.0100	U
127-18-4	Tetrachloroethene		0.7	0.00500	0.0100	U
79-01-6	Trichloroethene		0.5	0.00500	0.0100	U
75-01-4	Vinyl chloride		0.2	0.00500	0.0100	Q, X, U

SYSTEM MONITORING COMPOUND	ADDED (mg/L)	CONC (mg/L)	% REC	QC LIMITS	Q
Bromofluorobenzene	0.03000	0.02920	97.3	75 - 120	
Dibromofluoromethane	0.03000	0.03412	114	85 - 115	
1,2-Dichloroethane-d4	0.03000	0.03284	109	70 - 120	
Toluene-d8	0.03000	0.02586	86.2	85 - 120	

ANALYSIS DATA SHEET

STR1-IDW-02082012

Laboratory: Empirical Laboratories, LLC SDG: 1202065

Client: CH2M Hill, Inc. Project: MCAS Cherry Point CTO 026

Matrix: Solid Laboratory ID: 1202065-01 File ID: 0206501T.D

Sampled: 02/08/12 13:15 Prepared: 02/20/12 14:20 Analyzed: 02/27/12 19:29

Solids: Preparation: EXT_3510 Dilution: 1

Batch: 2B20004 Sequence: 2B06044 Calibration: 2049001 Instrument: MS-BNA1

CAS NO.	COMPOUND	CONC. (mg/L)	TCLP Reg Limit	LOD	LOQ	Q
106-46-7	1,4-Dichlorobenzene		0	0.0250	0.0500	U
121-14-2	2,4-Dinitrotoluene		0.13	0.0250	0.0500	U
118-74-1	Hexachlorobenzene		0.13	0.0250	0.0500	U
87-68-3	Hexachlorobutadiene		0.5	0.0250	0.0500	U
67-72-1	Hexachloroethane		3	0.0250	0.0500	U
95-48-7	2-Methylphenol		200	0.0250	0.0500	U
108-39-4/106	3-Methylphenol/4-Methylphenol		200	0.0250	0.0500	U
98-95-3	Nitrobenzene		2	0.0250	0.0500	U
87-86-5	Pentachlorophenol		100	0.100	0.200	U
110-86-1	Pyridine		5	0.0500	0.100	U
88-06-2	2,4,6-Trichlorophenol		2	0.0250	0.0500	U
95-95-4	2,4,5-Trichlorophenol		400	0.0250	0.0500	U

SYSTEM MONITORING COMPOUND	ADDED (mg/L)	CONC (mg/L)	% REC	QC LIMITS	Q
2-Fluorobiphenyl	0.5000	0.4269	85.4	50 - 110	
2-Fluorophenol	1.000	0.3241	32.4	20 - 110	
Nitrobenzene-d5	0.5000	0.3765	75.3	40 - 110	
Phenol-d6	1.000	0.2050	20.5	0 - 110	
Terphenyl-d14	0.5000	0.5142	103	50 - 135	
2,4,6-Tribromophenol	1.000	0.8107	81.1	40 - 125	

ANALYSIS DATA SHEET

STR1-IDW-02082012

Laboratory: Empirical Laboratories, LLC SDG: 1202065

Client: CH2M Hill, Inc. Project: MCAS Cherry Point CTO 026

Matrix: Solid Laboratory ID: 1202065-01 File ID: 019F1901.D

Sampled: 02/08/12 13:15 Prepared: 02/16/12 13:22 Analyzed: 02/16/12 19:21

Solids: Preparation: EXT_3510 Dilution: 1

Batch: 2B16003 Sequence: 2B05314 Calibration: 2047001 Instrument: GL-ECD3

CAS NO.	COMPOUND	CONC. (mg/L)	TCLP Reg Limit	LOD	LOQ	Q
72-20-8	Endrin		0.02	0.000100	0.000200	U
58-89-9	gamma-BHC (Lindane)		0.4	0.000100	0.000200	U
76-44-8	Heptachlor		0.008	0.000100	0.000200	U
1024-57-3	Heptachlor epoxide		0.008	0.000100	0.000200	U
72-43-5	Methoxychlor		10	0.000100	0.000200	U
57-74-9	Chlordane (tech)		0.03	0.000500	0.00100	U
8001-35-2	Toxaphene		0.5	0.00500	0.0100	U

SYSTEM MONITORING COMPOUND	ADDED (mg/L)	CONC (mg/L)	% REC	QC LIMITS	Q
Tetrachloro-m-xylene	0.005000	0.004587	91.7	25 - 140	
Tetrachloro-m-xylene [2C]	0.005000	0.004917	98.3	25 - 140	
Decachlorobiphenyl	0.005000	0.004053	81.1	40 - 135	
Decachlorobiphenyl [2C]	0.005000	0.004542	90.8	40 - 135	

* Values outside of QC limits

ANALYSIS DATA SHEET

STR1-IDW-02082012

Laboratory: Empirical Laboratories, LLC SDG: 1202065

Client: CH2M Hill, Inc. Project: MCAS Cherry Point CTO 026

Matrix: Solid Laboratory ID: 1202065-01 File ID: 005F1601.D

Sampled: 02/08/12 13:15 Prepared: 02/17/12 11:18 Analyzed: 03/01/12 00:37

Solids: Preparation: EXT_8151 Dilution: 1

Batch: 2B16004 Sequence: 2C06109 Calibration: 2061004 Instrument: GL-ECD4

CAS NO.	COMPOUND	CONC. (mg/L)	TCLP Reg Limit	LOD	LOQ	Q
93-72-1	2,4,5-TP (Silvex)		1	0.000500	0.00100	U
94-75-7	2,4-D		10	0.00500	0.0100	U

SYSTEM MONITORING COMPOUND	ADDED (mg/L)	CONC (mg/L)	% REC	QC LIMITS	Q
2,4-Dichlorophenylacetic acid	0.01000	0.008614	86.1	20 - 140	
2,4-Dichlorophenylacetic acid [2C]	0.01000	0.007750	77.5	20 - 140	

* Values outside of QC limits

ANALYSIS DATA SHEET

STR1-IDW-02082012

Laboratory: Empirical Laboratories, LLC
Client: CH2M Hill, Inc.
Matrix: Solid
Sampled: 02/08/12 13:15
% Solids: 0.00

SDG: 1202065
Project: MCAS Cherry Point CTO 026
Laboratory ID: 1202065-01
Received: 02/09/12 08:40

CAS NO.	Analyte	Conc. (mg/L)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7439-97-6	Mercury TCLP		0.000800	0.00200	0.00200	1	U	SW1311_7470A	2B16012	02/16/12 17:03
7440-38-2	Arsenic TCLP		0.0300	0.0600	0.100	1	U	SW1311_6010C	2B16005	02/20/12 17:07
7440-39-3	Barium TCLP	0.181	0.0500	0.100	0.400	1	J	SW1311_6010C	2B16005	02/20/12 17:07
7440-43-9	Cadmium TCLP		0.0100	0.0200	0.0500	1	U	SW1311_6010C	2B16005	02/20/12 17:07
7440-47-3	Chromium TCLP		0.0200	0.0400	0.100	1	U	SW1311_6010C	2B16005	02/20/12 17:07
7439-92-1	Lead TCLP		0.0150	0.0300	0.0300	1	U	SW1311_6010C	2B16005	02/20/12 17:07
7782-49-2	Selenium TCLP		0.0300	0.0500	0.100	1	U	SW1311_6010C	2B16005	02/20/12 17:07
7440-22-4	Silver TCLP		0.0100	0.0200	0.100	1	U	SW1311_6010C	2B16005	02/20/12 17:07

ANALYSIS DATA SHEET

STR1-IDW-02082012

Laboratory: Empirical Laboratories, LLC
Client: CH2M Hill, Inc.
Matrix: Solid
Sampled: 02/08/12 13:15
% Solids: 0.00

SDG: 1202065
Project: MCAS Cherry Point CTO 026
Laboratory ID: 1202065-01
Received: 02/09/12 08:40

CAS NO.	Analyte	Conc. (pH Units)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
GIS-210-014	Corrosivity	7.62	0.100	0.100	0.100	1		SW9045B	2B14015	02/14/12 13:50
CAS NO.	**Analyte**	**Conc. (mg/Kg dry)**	**DL**	**LOD**	**LOQ**	**D.F.**	**Q**	**Method**	**Batch**	**Analyzed**
57-12-5	Cyanide		0.168	0.336	1.01	1	U	SW9012A	2B21014	02/21/12 15:04
CAS NO.	**Analyte**	**Conc. (mg/Kg)**	**DL**	**LOD**	**LOQ**	**D.F.**	**Q**	**Method**	**Batch**	**Analyzed**
C-015	Reactive Sulfide		50.0	150	300	1	U	WChap.7.3.4.2MODIFIE	2B22016	02/22/12 15:07
CAS NO.	**Analyte**	**Conc. (°F)**	**DL**	**LOD**	**LOQ**	**D.F.**	**Q**	**Method**	**Batch**	**Analyzed**
NA	Ignitability	>158				1		SW1010A	2B21001	02/21/12 08:19

#15519 (1) 179408

NON-HAZARDOUS WASTE MANIFEST	1. Generator ID Number	2. Page 1 of	3. Emergency Response Phone	4. Waste Tracking Number
	NC1170027267	1 of 2	800-434-7750	0001

5. Generator's Name and Mailing Address
MCAS Cherry Point
PCS Box 8006
Cherry Point, NC 28533 USA

Generator's Site Address (if different than mailing address)
NC HWY 101 @ US 70 West
Havelock, NC 28533 USA

Generator's Phone: 252-466-4903

6. Transporter 1 Company Name: A&D Environmental Services, Inc. — U.S. EPA ID Number: NCD986232221

7. Transporter 2 Company Name: EQ Industrial Services — U.S. EPA ID Number: MIO000263871

8. Designated Facility Name and Site Address
EQ Florida, Inc.
2002 North Orient Road
Tampa, FL 33619

U.S. EPA ID Number: FLD981392494

Facility's Phone: 813-319-3418

	9. Waste Shipping Name and Description	10. Containers No.	10. Containers Type	11. Total Quantity	12. Unit Wt./Vol.	
1.	Non-Hazardous, Non-Regulated Sediment	1	DM	250	P	
2.				165.		
3.						
4.						

13. Special Handling Instructions and Additional Information

1) CTO-026 (water), Profile #: 414855, Approval MACS CP IDW(22/0)

A&D Job#: 65488 PO# 9151

14. GENERATOR'S CERTIFICATION: I certify the materials described above on this manifest are not subject to federal regulations for reporting proper disposal of Hazardous Waste.

Generator's/Offeror's Printed/Typed Name: John S. Myers — Signature: John S Myers — Month 05 Day 24 Year 2012

15. International Shipments ☐ Import to U.S. ☐ Export from U.S. Port of entry/exit:
Transporter Signature (for exports only): Date leaving U.S.:

16. Transporter Acknowledgment of Receipt of Materials

Transporter 1 Printed/Typed Name: Tony Jeffries — Signature: Tony Jeffries — Month 5 Day 24 Year 12

Transporter 2 Printed/Typed Name: Thomas Duesenberg — Signature: Thomas Duesenberg — Month 06 Day 05 Year 12

17. Discrepancy

17a. Discrepancy Indication Space ☐ Quantity ☐ Type ☐ Residue ☐ Partial Rejection ☐ Full Rejection

Manifest Reference Number:

17b. Alternate Facility (or Generator) — U.S. EPA ID Number

Facility's Phone:

17c. Signature of Alternate Facility (or Generator) — Month Day Year

18. Designated Facility Owner or Operator: Certification of receipt of materials covered by the manifest except as noted in Item 17a

Printed/Typed Name: ANN STEIGER — Signature: Ann Steiger — Month 6 Day 14 Year 12

GENERATOR | INTL | TRANSPORTER | DESIGNATED FACILITY

Please print or type. (Form designed for use on elite (12-pitch) typewriter.)

Form Approved. OMB No. 2050-0039

UNIFORM HAZARDOUS WASTE MANIFEST (Continuation Sheet)	21. Generator ID Number NC1170027267	22. Page 2	23. Manifest Tracking Number 0001

24. Generator's Name: MCAS CHERRY POINT

25. Transporter 3 Company Name: EQ INDUSTRIAL SERVICES — U.S. EPA ID Number: MJ0000263871

26. Transporter ____ Company Name — U.S. EPA ID Number

27a. HM	27b. U.S. DOT Description (including Proper Shipping Name, Hazard Class, ID Number, and Packing Group (if any))	28. Containers No.	28. Containers Type	29. Total Quantity	30. Unit Wt./Vol.	31. Waste Codes
	TRANSPORTATION ONLY					

32. Special Handling Instructions and Additional Information

TRANSPORTER

33. Transporter 3 Acknowledgment of Receipt of Materials
Printed/Typed Name: Craig England — Signature — Month 06 Day 13 Year 12

34. Transporter ____ Acknowledgment of Receipt of Materials
Printed/Typed Name — Signature — Month Day Year

DESIGNATED FACILITY

35. Discrepancy

36. Hazardous Waste Report Management Method Codes (i.e., codes for hazardous waste treatment, disposal, and recycling systems)

EPA Form 8700-22A (Rev. 3-05) Previous editions are obsolete.

DESIGNATED FACILITY TO DESTINATION STATE (IF REQUIRED)

Appendix D
2012 Raw Analytical Data

TABLE D-1
Raw Surface Soil Analytical Data
Former Skeet and Trap Range #1
MCAS Cherry Point, North Carolina

Station ID	STR01-SS01	STR01-SS02	STR01-SS03		STR01-SS04	STR01-SS05
Sample ID	STR01-SS01-0509	STR01-SS02-0509	STR01-SS03-0509	STR01-SS03-P-0509	STR01-SS04-0509	STR01-SS05-0509
Sample Date	05/19/09	05/19/09	05/19/09	05/19/09	05/19/09	05/19/09
Chemical Name						
Semivolatile Organic Compounds (UG/KG)						
2-Methylnaphthalene	80 U	79 U	81 U	81 U	76 U	81 U
Acenaphthene	80 U	79 U	81 U	81 U	76 U	81 U
Acenaphthylene	80 U	79 U	81 U	81 U	76 U	81 U
Anthracene	54 J	79 U	51 J	51 J	52 J	52 J
Benzo(a)anthracene	100 U	79 U	81 U	81 U	130 U	81 U
Benzo(a)pyrene	120 J	58	57	8.1 U	190	110
Benzo(b)fluoranthene	130 J	55 J	81 U	81 U	240	130
Benzo(g,h,i)perylene	69 J	25 J	81 U	22 J	150	71 J
Benzo(k)fluoranthene	88 J	63 J	81 U	81 U	110	84
Chrysene	38 J	79 UJ	81 UJ	81 UJ	88 J	17 J
Dibenz(a,h)anthracene	53	7.9 U	8.1 U	8.1 U	71	55
Fluoranthene	92 J	26 J	23 J	23 J	120	60 J
Fluorene	46 J	45 J	47 J	47 J	44 J	47 J
Indeno(1,2,3-cd)pyrene	83	41 J	81 U	81 U	150	85
Naphthalene	80 U	79 U	81 U	81 U	76 U	81 U
Phenanthrene	23 J	79 U	81 U	81 U	32 J	81 U
Pyrene	70 J	79 U	81 U	81 U	100	44 J
Explosives (UG/KG)						
Perchlorate	2.4 U	2.5 U	2.6 U	2.6 U	2.2 U	2.4 U
Total Metals (MG/KG)						
Aluminum	3,980 J	1,170 J	7,280 J	7,820 J	1,160 J	5,510 J
Antimony	3.4 UJ	3.5 UJ	3.7 UJ	3.4 UJ	3.3 UJ	3.5 UJ
Arsenic	2.4	0.82 J	3.7	3	0.69 J	2.9
Barium	7.6 J	4.5 J	25.3	25.8	3.6 J	12.7
Beryllium	1.1 U	1.2 U	0.32 J	0.32 J	1.1 U	1.2 U
Cadmium	1.1 U	1.2 U	1.2 U	1.1 U	1.1 U	1.2 U
Calcium	360 J	288 J	1,240	1,260	292 J	473 J
Chromium	7	2.8	12.6	13.4	2.6	10
Cobalt	3.4 U	3.5 U	2.5 J	2.8 J	3.3 U	3.5 U
Copper	2.3 U	2.3 U	2.5 U	1.2 J	2.2 U	2.3 U
Iron	4,520 J	1,970 J	12,400 J	11,600 J	2,150 J	7,880 J
Lead	7.1	3	5.8	6	8.1	11
Magnesium	329 J	1,170 U	1,080 J	1,100 J	1,090 U	423 J
Manganese	18.1	9.7	50.2	49	13.1	18.2
Mercury	0.037 U	0.041 U	0.036 U	0.042 U	0.034 U	0.024 J
Nickel	1.3 J	0.87 J	3.9	3.9	0.84 J	2.3 J
Potassium	371 J	1,170 U	539 J	549 J	1,090 U	388 J
Selenium	1.1 U	1.2 U	0.87 J	0.74 J	1.1 U	1.2 U
Silver	2.3 U	2.3 U	2.5 U	2.3 U	2.2 U	2.3 U
Sodium	1,150 U	1,170 U	463 J	475 J	1,090 U	1,160 U
Thallium	2.3 U	2.3 U	2.5 U	2.3 U	2.2 U	2.3 U
Vanadium	10	4.1	18.7	18.4	4.1	16.6
Zinc	5.5	2.9 J	19.1	19.9	11.4	10.1

Notes:

Shading indicates detections
NA - Not analyzed
J - Analyte present, value may or may not be accurate or precise
U - The material was analyzed for, but not detected
UJ - Analyte not detected, quantitation limit may be inaccurate
MG/KG - Milligrams per kilogram
UG/KG - Micrograms per kilogram

TABLE D-2
Raw Sediment Analytical Data - 2009
Former Skeet and Trap Range #1
MCAS Cherry Point, North Carolina

Station ID	STR01-SD01			STR01-SD02		
Sample ID	STR01-SD01-0-1-0509	STR01-SSD01-1-2-0509	STR01-SSD01-2-3-0509	STR01-SD02-0-1-0509	STR01-SSD02-1-2-0509	STR01-SSD02-2-3-0509
Sample Date	05/21/09	05/21/09	05/21/09	05/21/09	05/21/09	05/21/09
Chemical Name						
Semivolatile Organic Compounds (UG/KG)						
2-Methylnaphthalene	4.8 J	84 U	86 U	86 U	89 U	88 U
Acenaphthene	13 J	84 U	86 U	86 U	89 U	88 U
Acenaphthylene	83 U	84 U	86 U	86 U	89 U	88 U
Anthracene	17 J	84 U	86 U	86 U	89 U	88 U
Benzo(a)anthracene	590	84 U	86 UJ	86 U	89 U	5.6 J
Benzo(a)pyrene	1,400	8.4 U	8.6 U	13	8.9 U	8.8 U
Benzo(b)fluoranthene	1,900	84 U	86 U	15 J	89 U	88 U
Benzo(g,h,i)perylene	800	84 U	86 U	7.4 J	89 U	88 U
Benzo(k)fluoranthene	550	84 U	86 U	10 J	89 U	88 U
Chrysene	670	84 U	86 UJ	2 J	89 U	88 UJ
Dibenz(a,h)anthracene	8.3 U	8.4 U	8.6 U	8.6 U	8.9 U	8.8 U
Fluoranthene	300	3 J	3.1 J	17 J	89 U	3.3 J
Fluorene	14 J	84 U	86 U	6.5 J	6.6 J	88 U
Indeno(1,2,3-cd)pyrene	790	84 U	86 U	86 U	89 U	88 U
Naphthalene	18 J	84 U	86 U	86 U	89 U	88 U
Phenanthrene	39 J	84 U	86 U	5 J	89 U	88 U
Pyrene	370	84 U	86 U	12 J	89 U	88 U
Total Metals (MG/KG)						
Aluminum	777 J	2,610 J	2,490 J	777 J	1,200 J	7,340 J
Antimony	3.7 U	3.8 U	3.7 U	3.8 U	4 U	3.7 U
Arsenic	2.5 U	6.4	4.6	0.86 J	1 J	4.4
Barium	1.7 J	17.2	17.7	1.8 J	2.7 J	12.7
Beryllium	1.2 U	1.3 U	1.2 U	1.3 U	1.3 U	0.38 J
Cadmium	1.2 U	0.54 J	0.35 J	1.3 U	1.3 U	1.2 U
Calcium	333 J	190,000 J	185,000	1,270 U	323 J	602 J
Chromium	2.5	7.1	7.2	2.4 J	3	18.8
Cobalt	3.7 U	1.4 J	1.3 J	3.8 U	4 U	2.9 J
Copper	2.5 U	1.9 J	1.9 J	2.5 U	2.7 U	2.2 J
Iron	1,330	6,210	5,880	1,120	1,770	10,900
Lead	2.4	1.4	2.3	2.9	7.1	6.2
Magnesium	285 J	1,780	2,040	291 J	384 J	1,780
Manganese	14.4	43	48.6	11.7	17.7	26.8
Mercury	0.039 U	0.039 U	0.043 U	0.04 U	0.04 U	0.043 U
Nickel	2.5 U	2.7	3.1	2.5 U	2.7 U	5.3
Potassium	1,240 U	624 J	643 J	1,270 U	1,340 U	1,460 J
Selenium	1.2 U	0.96 J	1.2 U	1.3 U	1.3 U	0.87 J
Silver	2.5 U	2.5 U	2.5 U	2.5 U	2.7 U	2.4 U
Sodium	911 J	2,400	2,000	1,230 J	1,390	1,810
Thallium	2.5 U	2.5 U	2.5 U	2.5 U	2.7 U	2.4 U
Vanadium	2.6 J	9.1	8.9	2.4 J	3.5 J	18.3
Zinc	4.2 J	9.2	12.4	4.2 J	8.7	18.2
Wet Chemistry						
Total organic carbon (TOC) (mg/kg)	NA	NA	NA	NA	NA	NA
Grain Size (PCT/P)						
Clay (%)	NA	NA	NA	NA	NA	NA
Gravel (%)	NA	NA	NA	NA	NA	NA
Sand (%)	NA	NA	NA	NA	NA	NA
Silt (%)	NA	NA	NA	NA	NA	NA

Notes:

Shading indicates detections

NA - Not analyzed

J - Analyte present, value may or may not be accurate or precise

U - The material was analyzed for, but not detected

UJ - Analyte not detected, quantitation limit may be inaccurate

MG/KG - Milligrams per kilogram

PCT/P - Percent Passed

UG/KG - Micrograms per kilogram

TABLE D-2
Raw Sediment Analytical Data - 2009
Former Skeet and Trap Range #1
MCAS Cherry Point, North Carolina

Station ID	STR01-SD03					
Sample ID	STR01-SD03-0-1-0509	STR01-SD03-P-0-1-0509	STR01-SSD03-1-2-0509	STR01-SSD03-P-1-2-0509	STR01-SSD03-2-3-0509	STR01-SSD03-P-2-3-0509
Sample Date	05/21/09	05/21/09	05/21/09	05/21/09	05/21/09	05/21/09
Chemical Name						
Semivolatile Organic Compounds (UG/KG)						
2-Methylnaphthalene	83 U	92 U	84 U	85 U	100 U	100 U
Acenaphthene	83 U	15 J	84 U	85 U	100 U	100 U
Acenaphthylene	83 U	92 U	84 U	85 U	100 U	100 U
Anthracene	83 U	92 U	6.7 J	6.9 J	100 U	100 U
Benzo(a)anthracene	83 U	320	84 U	85 U	100 UJ	100 UJ
Benzo(a)pyrene	7.8 J	370 J	8.4 U	8.5 U	10 U	10 U
Benzo(b)fluoranthene	7.2 J	470 J	84 U	7.1 J	100 U	100 U
Benzo(g,h,i)perylene	3.4 J	240 J	84 U	85 U	100 U	100 U
Benzo(k)fluoranthene	8.4 J	92 U	84 U	8.4 J	100 U	100 U
Chrysene	83 U	340	84 U	85 U	100 UJ	100 UJ
Dibenz(a,h)anthracene	8.3 U	36	8.4 U	8.5 U	10 U	10 U
Fluoranthene	83 U	420	84 U	85 U	4 J	4.1 J
Fluorene	83 U	12 J	6.2 J	6.3 J	7.6 J	7.7 J
Indeno(1,2,3-cd)pyrene	83 U	230	84 U	85 U	100 U	100 U
Naphthalene	83 U	6.6 J	84 U	85 U	100 U	100 U
Phenanthrene	83 U	110	84 U	85 U	100 U	100 U
Pyrene	2.1 J	380 J	84 U	2.2 J	8.7 J	16 J
Total Metals (MG/KG)						
Aluminum	1,260 J	1,110 J	1,870 J	1,690 J	2,290 J	1,490 J
Antimony	3.6 U	4.1 U	3.7 U	3.7 U	4.3 U	4.6 U
Arsenic	0.76 J	2.7 U	1.5 J	1.2 J	1.2 J	3.1 U
Barium	1.8 J	1.9 J	3.2 J	2.9 J	4.7 J	3.9 J
Beryllium	1.2 U	1.4 U	1.2 U	1.2 U	1.4 U	1.5 U
Cadmium	1.2 U	1.4 U	1.2 U	1.2 U	1.4 U	1.5 U
Calcium	1,190 U	1,350 U	1,270	438 J	1,120 J	997 J
Chromium	2.7	4	4.2	4	5.2	3.5
Cobalt	3.6 U	4.1 U	3.7 U	3.7 U	4.3 U	4.6 U
Copper	1.6 J	2.7 U	2.5 U	2.5 U	2.8 U	3.1 U
Iron	1,150	1,300	3,040	2,910	5,760	4,710
Lead	2.5	3.1	2.1	1.8	2.3	2.5
Magnesium	271 J	1,350 U	533 J	505 J	912 J	814 J
Manganese	17.8	18.1	33.3	31.3	29.8	24
Mercury	0.039 U	0.041 U	0.041 U	0.04 U	0.05 U	0.048 U
Nickel	2.4 U	1.3 J	1 J	1.1 J	1.6 J	1.1 J
Potassium	1,190 U	1,350 U	312 J	311 J	392 J	1,530 U
Selenium	1.2 U	1.4 U	1.2 U	1.2 U	1.4 U	1.5 U
Silver	2.4 U	2.7 U	2.5 U	2.5 U	2.8 U	3.1 U
Sodium	1,040 J	658 J	1,580	1,520	2,310	2,120
Thallium	2.4 U	2.7 U	2.5 U	2.5 U	2.8 U	3.1 U
Vanadium	2.6 J	2.9 J	4.6	4.5	6.6	4.5 J
Zinc	4.7 J	5 J	4.4 J	4.2 J	8.1	6 J
Wet Chemistry						
Total organic carbon (TOC) (mg/kg)	NA	NA	NA	NA	NA	NA
Grain Size (PCT/P)						
Clay (%)	NA	NA	NA	NA	NA	NA
Gravel (%)	NA	NA	NA	NA	NA	NA
Sand (%)	NA	NA	NA	NA	NA	NA
Silt (%)	NA	NA	NA	NA	NA	NA

Notes:

Shading indicates detections

NA - Not analyzed

J - Analyte present, value may or may not be accurate or precise

U - The material was analyzed for, but not detected

UJ - Analyte not detected, quantitation limit may be inaccurate

MG/KG - Milligrams per kilogram

PCT/P - Percent Passed

UG/KG - Micrograms per kilogram

TABLE D-2
Raw Sediment Analytical Data - 2009
Former Skeet and Trap Range #1
MCAS Cherry Point, North Carolina

Station ID	STR01-SD04			STR01-SD05			STR01-SD06		
Sample ID	STR01-SD04-0-1-0509	STR01-SSD04-1-2-0509	STR01-SSD04-2-3-0509	STR01-SD05-0-1-0509	STR01-SSD05-1-2-0509	STR01-SSD05-2-3-0509	STR01-SD06-0-1-0509	STR01-SSD06-1-2-0509	STR01-SSD06-2-3-0509
Sample Date	05/21/09	05/21/09	05/21/09	05/21/09	05/21/09	05/21/09	05/21/09	05/21/09	05/21/09
Chemical Name									
Semivolatile Organic Compounds (UG/KG)									
2-Methylnaphthalene	74 U	82 U	82 U	73 U	80 U	84 U	79 U	83 U	82 U
Acenaphthene	2 J	82 U	82 U	73 U	80 U	84 U	79 U	83 U	82 U
Acenaphthylene	74 U	82 U	82 U	73 U	80 U	84 U	79 U	83 U	82 U
Anthracene	8.9 J	82 U	82 U	73 U	6.5 J	84 U	7.6 J	6.6 J	82 U
Benzo(a)anthracene	56 J	82 U	82 U	73 U	80 U	5.9 J	79 U	83 U	82 UJ
Benzo(a)pyrene	120	8.2 U	8.2 U	6.8 J	8 U	8.4 U	13	8.3 U	8.2 U
Benzo(b)fluoranthene	160	82 U	82 U	6.3 J	80 U	84 U	13 J	83 U	82 U
Benzo(g,h,i)perylene	120	82 U	82 U	3.1 J	3.1 J	3.3 J	7.3 J	83 U	82 U
Benzo(k)fluoranthene	38 J	8.2 J	82 U	7.3 J	80 U	84 U	10 J	83 U	82 U
Chrysene	55 J	82 U	82 U	73 U	80 U	84 UJ	3.3 J	83 U	82 UJ
Dibenz(a,h)anthracene	7.4 U	8.2 U	8.2 U	7.3 U	8 U	8.4 U	7.9 U	8.3 U	8.2 U
Fluoranthene	74	82 U	3 J	73 U	80 U	4.2 J	79 U	83 U	82 U
Fluorene	6.2 J	82 U	82 U	5.4 J	6 J	6.3 J	6.6 J	6.1 J	82 U
Indeno(1,2,3-cd)pyrene	110	82 U	82 U	73 U	80 U	84 U	79 U	83 U	82 U
Naphthalene	74 U	82 U	82 U	73 U	80 U	84 U	79 U	83 U	82 U
Phenanthrene	19 J	82 U	82 U	73 U	80 U	2.2 J	2.8 J	83 U	82 U
Pyrene	72 J	82 U	82 U	1.7 J	80 U	2.3 J	7.3 J	83 U	82 U
Total Metals (MG/KG)									
Aluminum	771 J	1,290 J	1,390 J	727 J	763 J	474 J	1,100 J	1,160 J	679 J
Antimony	3.1 U	3.6 U	3.7 U	3.1 U	3.6 U	3.5 U	3.5 U	3.6 U	3.5 U
Arsenic	2.1 U	2.4 U	0.78 J	2.1 U	2.4 U	2.3 U	2.3 U	2.4 U	2.3 U
Barium	1.4 J	2.1 J	2.6 J	1.6 J	1.5 J	9.2 U	1.5 J	2 J	1.7 J
Beryllium	1 U	1.2 U	1.2 U	1 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U
Cadmium	1 U	1.2 U	1.2 U	1 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U
Calcium	1,030 U	1,210 U	292 J	1,050 U	1,190 U	1,150 U	283 J	1,190 U	1,160 U
Chromium	2.2	3	3.1	2.1 J	1.9 J	1 J	2.2 J	3	1.5 J
Cobalt	3.1 U	3.6 U	3.7 U	3.1 U	3.6 U	3.5 U	3.5 U	3.6 U	3.5 U
Copper	2.1 U	2.4 U	2.4 U	2.1 U	2.4 U	2.3 U	1.5 J	2.4 U	2.3 U
Iron	1,130	2,010	2,270	911	843	572	969	1,830	702
Lead	2.2	1.7	1.8	4.2	1.6	0.73	2.7	1.5	1.2
Magnesium	1,030 U	373 J	432 J	1,050 U	249 J	1,150 U	1,160 U	388 J	238 J
Manganese	10.3	22.5	20.2	10.3	10.9	5.4	12	21.9	7.8
Mercury	0.038 U	0.043 U	0.039 U	0.034 U	0.04 U	0.039 U	0.042 U	0.042 U	0.04 U
Nickel	2.1 U	2.4 U	0.84 J	2.1 U	2.4 U	2.3 U	2.3 U	2.4 U	2.3 U
Potassium	1,030 U	1,210 U	1,220 U	1,050 U	1,190 U	1,150 U	1,160 U	1,190 U	1,160 U
Selenium	1 U	1.2 U	1.2 U	1 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U
Silver	2.1 U	2.4 U	2.4 U	2.1 U	2.4 U	2.3 U	2.3 U	2.4 U	2.3 U
Sodium	396 J	1,090 J	1,170 J	389 J	1,090 J	725 J	619 J	1,410	1,160
Thallium	2.1 U	2.4 U	2.4 U	2.1 U	2.4 U	2.3 U	2.3 U	2.4 U	2.3 U
Vanadium	2.3 J	3.2 J	4.1	2 J	2.4 J	3.5 U	2.2 J	3.1 J	1.5 J
Zinc	3.9 J	3.2 J	3.4 J	2.7 J	1.4 J	4.6 U	3.7 J	2.8 J	1.4 J
Wet Chemistry									
Total organic carbon (TOC) (mg/kg)	770 J	1,110 J	NA	NA	NA	NA	NA	NA	NA
Grain Size (PCT/P)									
Clay (%)	0	0	0	NA	NA	NA	NA	NA	NA
Gravel (%)	0	0	0	NA	NA	NA	NA	NA	NA
Sand (%)	93	84	89.5	NA	NA	NA	NA	NA	NA
Silt (%)	7	16	10.5	NA	NA	NA	NA	NA	NA

Notes:

Shading indicates detections

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UJ - Analyte not detected, quantitation limit may be inaccurate

MG/KG - Milligrams per kilogram

PCT/P - Percent Passed

UG/KG - Micrograms per kilogram

TABLE D-2
Raw Sediment Analytical Data - 2009
Former Skeet and Trap Range #1
MCAS Cherry Point, North Carolina

Station ID	STR01-SD07						
Sample ID	STR01-SD07-0-1-0509	STR01-SSD07-1-2-0509	STR01-SSD07-P-1-2-0509	STR01-SSD07-2-3-0509	STR01-SSD07-3-4-0509	STR01-SSD07-4-5-0509	STR01-SSD07-5-6-0509
Sample Date	05/21/09	05/21/09	05/21/09	05/21/09	05/21/09	05/21/09	05/21/09
Chemical Name							
Semivolatile Organic Compounds (UG/KG)							
2-Methylnaphthalene	76 U	73 U	72 U	82 U	82 U	82 U	86 U
Acenaphthene	76 U	73 U	72 U	82 U	82 U	82 U	86 U
Acenaphthylene	76 U	73 U	72 U	82 U	82 U	82 U	86 U
Anthracene	76 U	73 U	5.7 J	82 U	82 U	82 U	86 U
Benzo(a)anthracene	76 U	73 U	72 U	82 UJ	5.1 J	5.2 J	5.4 J
Benzo(a)pyrene	7.6 U	7.3 U	6.4 J	8.2 U	8.2 U	8.2 U	8.6 U
Benzo(b)fluoranthene	76 U	73 U	72 U	82 U	82 U	82 U	86 U
Benzo(g,h,i)perylene	76 U	73 U	2.8 J	82 U	82 U	82 U	86 U
Benzo(k)fluoranthene	7.6 J	73 U	72 U	82 U	82 U	82 U	86 U
Chrysene	76 U	73 U	72 U	82 UJ	82 U	82 UJ	86 UJ
Dibenz(a,h)anthracene	7.6 U	7.3 U	7.2 U	8.2 U	8.2 U	8.2 U	8.6 U
Fluoranthene	3.5 J	2.7 J	72 U	3 J	3 J	3 J	3.2 J
Fluorene	76 U	5.3 J	5.3 J	82 U	82 U	82 U	6.3 J
Indeno(1,2,3-cd)pyrene	4.8 U	73 U	72 U	82 U	82 U	82 U	86 U
Naphthalene	76 U	73 U	72 U	82 U	82 U	82 U	86 U
Phenanthrene	76 U	73 U	72 U	82 U	82 U	82 U	86 U
Pyrene	1.8 J	73 U	72 U	82 U	82 U	82 U	86 U
Total Metals (MG/KG)							
Aluminum	806 J	527 J	604 J	1,580 J	916 J	839 J	1,940 J
Antimony	3.4 U	3.1 U	3 U	3.6 U	3.6 U	3.5 U	3.8 U
Arsenic	2.3 U	2.1 U	2 U	1.1 J	2.4 U	0.97 J	1.3 J
Barium	2 J	8.3 U	1.2 J	2.7 J	1.7 J	1.6 J	3 J
Beryllium	1.1 U	1 U	0.99 U	1.2 U	1.2 U	1.2 U	1.3 U
Cadmium	1.1 U	1 U	0.99 U	1.2 U	1.2 U	1.2 U	1.3 U
Calcium	1,140 U	259 J	990 U	1,200 U	323 J	751 J	378 J
Chromium	2.1 J	1.2 J	1.5 J	3.8	2.5	2.3 J	4.2
Cobalt	3.4 U	3.1 U	3 U	3.6 U	3.6 U	3.5 U	3.8 U
Copper	2.3 U	2.1 U	2 U	2.4 U	2.4 U	2.4 U	2.6 U
Iron	1,040	746	874	3,230	1,660	2,000	3,390
Lead	4	0.66	0.9	2.5	1.7	1.6	2.2
Magnesium	1,140 U	1,040 U	990 U	476 J	294 J	254 J	469 J
Manganese	11	8.7	10.2	27.4	22.6	24.9	36.5
Mercury	0.038 U	0.034 U	0.035 U	0.035 U	0.035 U	0.04 U	0.039 U
Nickel	2.3 U	2.1 U	2 U	0.99 J	2.4 U	2.4 U	0.77 J
Potassium	1,140 U	1,040 U	990 U	302 J	1,190 U	1,180 U	330 J
Selenium	1.1 U	1 U	0.99 U	1.2 U	1.2 U	1.2 U	1.3 U
Silver	2.3 U	2.1 U	2 U	2.4 U	2.4 U	2.4 U	2.6 U
Sodium	441 J	386 J	538 J	1,360	1,220	1,160 J	1,530
Thallium	2.3 U	2.1 U	2 U	2.4 U	2.4 U	2.4 U	2.6 U
Vanadium	2.1 J	1.3 J	1.5 J	5	3.6	3 J	5.8
Zinc	3.8 J	1.2 J	1.4 J	4.7 J	2.1 J	1.8 J	3.6 J
Wet Chemistry							
Total organic carbon (TOC) (mg/kg)	990 J	1,600 U	476 J	NA	NA	NA	NA
Grain Size (PCT/P)							
Clay (%)	0	0	0	2	1	1	2
Gravel (%)	0	0	0	0.1	0	0	0
Sand (%)	91	94	94	88.6	92.5	93.1	86.3
Silt (%)	9	6	6	9.4	6.5	5.9	11.7

Notes:

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MG/KG - Milligrams per kilogram

PCT/P - Percent Passed

UG/KG - Micrograms per kilogram

TABLE D-2
Raw Sediment Analytical Data - 2009
Former Skeet and Trap Range #1
MCAS Cherry Point, North Carolina

Station ID	STR01-SD08					
Sample ID	STR01-SD08-0-1-0509	STR01-SSD08-1-2-0509	STR01-SSD08-2-3-0509	STR01-SSD08-3-4-0509	STR01-SSD08-4-5-0509	STR01-SSD08-5-6-0509
Sample Date	05/21/09	05/21/09	05/21/09	05/21/09	05/21/09	05/21/09
Chemical Name						
Semivolatile Organic Compounds (UG/KG)						
2-Methylnaphthalene	84 U	89 U	92 U	100 U	140 U	120 U
Acenaphthene	84 U	89 U	92 U	100 U	140 U	120 U
Acenaphthylene	84 U	89 U	92 U	100 U	140 U	120 U
Anthracene	6.9 J	7.4 J	92 U	100 U	140 U	120 U
Benzo(a)anthracene	84 U	89 U	92 UJ	100 UJ	140 UJ	120 UJ
Benzo(a)pyrene	8.3 J	8.9 U	9.2 U	10 U	14 U	12 U
Benzo(b)fluoranthene	7.9 J	89 U	92 U	100 U	140 U	120 U
Benzo(g,h,i)perylene	4 J	3.5 J	92 U	100 U	140 U	120 U
Benzo(k)fluoranthene	8.6 J	89 U	92 U	100 U	140 U	120 U
Chrysene	84 U	89 U	92 UJ	100 UJ	140 UJ	120 UJ
Dibenz(a,h)anthracene	8.4 U	8.9 U	9.2 U	10 U	14 U	12 U
Fluoranthene	84 U	89 U	3.5 J	4.3 J	5.5 J	4.9 J
Fluorene	6.3 J	89 U	6.8 J	7.8 J	10 J	8.9 J
Indeno(1,2,3-cd)pyrene	84 U	89 U	92 U	100 U	140 U	120 U
Naphthalene	84 U	89 U	92 U	100 U	140 U	120 U
Phenanthrene	84 U	89 U	92 U	100 U	140 U	120 U
Pyrene	2.8 J	2.4 J	92 U	100 U	140 U	2.9 J
Total Metals (MG/KG)						
Aluminum	1,160 J	1,730	2,360 J	7,300 J	12,100 J	7,620 J
Antimony	3.7 U	4 U	3.9 U	4.7 U	5.9 U	5.3 U
Arsenic	2.5 U	1 J	1.4 J	2.3 J	2.7 J	2.2 J
Barium	2 J	3 J	4.5 J	11.9 J	20.2	13 J
Beryllium	1.2 U	1.3 U	1.3 U	0.42 J	0.69 J	0.47 J
Cadmium	1.2 U	1.3 U	1.3 U	1.6 U	2 U	1.8 U
Calcium	1,240 U	295 J	1,040 J	1,670	2,950	1,820
Chromium	2.8	3.9	4.7	10.3	16.6	10.8
Cobalt	3.7 U	4 U	3.9 U	3.2 J	5.3 J	3.9 J
Copper	2.5 U	2.7 U	2.6 U	2.6 J	4.5	3.5 J
Iron	1,470	2,890	5,050	12,800	20,700	14,500
Lead	4.2	2.6	2.2	3.8	5.7	4.5
Magnesium	255 J	484 J	808 J	1,400 J	2,010	1,200 J
Manganese	14.5	33.8	48.1	129	199	130
Mercury	0.039 U	0.042 U	0.042 U	0.046 U	0.07 U	0.058 U
Nickel	0.75 J	2.7 U	1.7 J	4	6.8	4.6
Potassium	1,240 U	1,330 U	440 J	842 J	1,290 J	810 J
Selenium	1.2 U	1.3 U	1.3 U	1.6 U	2 U	1.8 U
Silver	2.5 U	2.7 U	2.6 U	3.1 U	3.9 U	3.5 U
Sodium	931 J	1,660	2,020	2,390	2,880	1,820
Thallium	2.5 U	2.7 U	2.6 U	3.1 U	3.9 U	3.5 U
Vanadium	2.9 J	4	6.2	12.2	17.4	11.5
Zinc	6.2	4.3 J	8	17.1	29.3	21.2
Wet Chemistry						
Total organic carbon (TOC) (mg/kg)	NA	NA	NA	NA	NA	NA
Grain Size (PCT/P)						
Clay (%)	NA	NA	NA	NA	NA	NA
Gravel (%)	NA	NA	NA	NA	NA	NA
Sand (%)	NA	NA	NA	NA	NA	NA
Silt (%)	NA	NA	NA	NA	NA	NA

Notes:

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MG/KG - Milligrams per kilogram

PCT/P - Percent Passed

UG/KG - Micrograms per kilogram

TABLE D-2
Raw Sediment Analytical Data - 2009
Former Skeet and Trap Range #1
MCAS Cherry Point, North Carolina

Station ID	STR01-SD09				STR01-SD10	
Sample ID	STR01-SD09-0-1-0509	STR01-SD09-P-0-1-0509	STR01-SSD09-1-2-0509	STR01-SSD09-2-3-0509	STR01-SD10-0-1-0509	STR01-SSD10-1-2-0509
Sample Date	05/21/09	05/21/09	05/21/09	05/21/09	05/21/09	05/21/09
Chemical Name						
Semivolatile Organic Compounds (UG/KG)						
2-Methylnaphthalene	110 U	110 U	100 U	110 U	81 U	83 U
Acenaphthene	110 U	110 U	100 U	110 U	81 U	83 U
Acenaphthylene	110 U	110 U	100 U	110 U	81 U	83 U
Anthracene	110 U	11 J	10 J	110 U	6.5 J	83 U
Benzo(a)anthracene	110 U	110 U	100 U	15 J	81 U	83 U
Benzo(a)pyrene	19	16	13	20	8.1 U	8.3 U
Benzo(b)fluoranthene	20 J	16 J	14 J	23 J	6.7 J	83 U
Benzo(g,h,i)perylene	13 J	8.6 J	8.6 J	12 J	81 U	83 U
Benzo(k)fluoranthene	14 J	14 J	13 J	15 J	8 J	83 U
Chrysene	2.1 J	110 U	100 U	4.7 J	81 U	83 U
Dibenz(a,h)anthracene	8.7 J	11 U	10 J	11 U	8.1 U	8.3 U
Fluoranthene	110 U	16 J	100 U	16 J	81 U	83 U
Fluorene	110 U	110 U	8.9 J	9 J	6 J	6.2 J
Indeno(1,2,3-cd)pyrene	110 U	110 U	100 U	110 U	81 U	83 U
Naphthalene	110 U	110 U	100 U	110 U	81 U	83 U
Phenanthrene	3.4 J	6.9 J	3.6 J	5.7 J	81 U	83 U
Pyrene	11 J	12 J	8.8 J	15 J	81 U	18 J
Total Metals (MG/KG)						
Aluminum	5,690 J	5,680 J	5,800 J	11,900 J	657 J	571 J
Antimony	4.9 U	5.1 U	4.6 U	5 U	3.6 U	3.7 U
Arsenic	2.5 J	2.3 J	2.3 J	4	2.4 U	0.81 J
Barium	7.8 J	7.8 J	9.3 J	17.3	1.6 J	10 U
Beryllium	1.6 U	1.7 U	1.5 U	0.47 J	1.2 U	1.2 U
Cadmium	0.36 J	0.36 J	0.39 J	0.56 J	1.2 U	1.2 U
Calcium	1,820	626 J	2,510	1,150 J	1,200 U	380 J
Chromium	9.1	9.4	10	18.5	2.1 J	2.5 J
Cobalt	1.9 J	2 J	1.8 J	3.3 J	3.6 U	3.7 U
Copper	3.7	3.7	3.8	7.6	2.4 U	2.5 U
Iron	7,540	7,720	7,970	17,000	994	1,380
Lead	6.1	6.6	7.7	17.4	1.5	0.58 J
Magnesium	1,080 J	1,060 J	1,130 J	1,780	1,200 U	290 J
Manganese	111	101	145	161	11.8	8.9
Mercury	0.05 U	0.059 U	0.028 J	0.062	0.037 U	0.038 U
Nickel	2.7 J	2.8 J	2.7 J	5.2	2.4 U	0.88 J
Potassium	605 J	646 J	566 J	1,030 J	1,200 U	1,250 U
Selenium	1.6 U	1.7 U	1.5 U	1.7 U	1.2 U	1.2 U
Silver	3.3 U	3.4 U	3 U	3.3 U	2.4 U	2.5 U
Sodium	3,160	2,860	2,950	2,640	571 J	1,300
Thallium	3.3 U	3.4 U	3 U	3.3 U	2.4 U	2.5 U
Vanadium	11.9	11.4	11.9	24.6	2 J	2.5 J
Zinc	24.4	24	24.4	40.3	2.4 J	2.7 J
Wet Chemistry						
Total organic carbon (TOC) (mg/kg)	9,200	6,780	6,750	NA	NA	NA
Grain Size (PCT/P)						
Clay (%)	6	4	4	10.1	NA	NA
Gravel (%)	0	0	0	1.6	NA	NA
Sand (%)	69	65	66	47.3	NA	NA
Silt (%)	25	31	30	41	NA	NA

Notes:

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MG/KG - Milligrams per kilogram

PCT/P - Percent Passed

UG/KG - Micrograms per kilogram

TABLE D-2
Raw Sediment Analytical Data - 2009
Former Skeet and Trap Range #1
MCAS Cherry Point, North Carolina

Station ID	STR01-SD11			STR01-SD12		
Sample ID	STR01-SD11-0-1-0509	STR01-SSD11-1-2-0509	STR01-SSD11-2-3-0509	STR01-SD12-0-1-0509	STR01-SSD12-1-2-0509	STR01-SSD12-2-3-0509
Sample Date	05/21/09	05/21/09	05/21/09	05/21/09	05/21/09	05/21/09
Chemical Name						
Semivolatile Organic Compounds (UG/KG)						
2-Methylnaphthalene	83 U	85 U	85 U	2.8 J	86 U	180 U
Acenaphthene	83 U	85 U	85 U	86 U	86 U	180 U
Acenaphthylene	83 U	85 U	85 U	86 U	86 U	180 U
Anthracene	6.6 J	6.9 J	85 U	86 U	6.9 J	180 U
Benzo(a)anthracene	83 U	85 U	5.3 J	86 U	86 U	180 UJ
Benzo(a)pyrene	8.3 U	8.5 U	8.5 U	8.6 U	8.6 U	18 U
Benzo(b)fluoranthene	83 U	85 U	85 U	7.1 J	86 U	180 U
Benzo(g,h,i)perylene	3.2 J	3.2 J	85 U	86 U	86 U	180 U
Benzo(k)fluoranthene	83 U	85 U	85 U	86 U	86 U	180 U
Chrysene	83 U	85 U	85 UJ	86 U	86 U	180 UJ
Dibenz(a,h)anthracene	8.3 U	8.5 U	8.5 U	8.6 U	8.6 U	18 U
Fluoranthene	83 U	85 U	3.1 J	86 U	86 U	14 J
Fluorene	6.1 J	6.4 J	6.2 J	6.8 J	6.4 J	14 J
Indeno(1,2,3-cd)pyrene	83 U	85 U	85 U	86 U	86 U	180 U
Naphthalene	83 U	85 U	85 U	3.6 J	86 U	9.1 J
Phenanthrene	83 U	85 U	85 U	86 U	86 U	9.3 J
Pyrene	83 U	85 U	85 U	86 U	86 U	8.5 J
Total Metals (MG/KG)						
Aluminum	1,250 J	1,440 J	1,420 J	1,570 J	2,230 J	15,300 J
Antimony	3.6 U	3.7 U	3.7 U	3.7 U	3.7 U	8 U
Arsenic	2.4 U	0.86 J	2.4 U	2.5 U	1.2 J	3.3 J
Barium	2.1 J	2.4 J	3 J	2.6 J	3.2 J	23.7
Beryllium	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	0.88 J
Cadmium	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	2.7 U
Calcium	409 J	1,230 U	1,220 U	736 J	275 J	4,140
Chromium	2.8	2.9	2.8	3.3	3.7	18.3
Cobalt	3.6 U	3.7 U	3.7 U	3.7 U	3.7 U	3.6 J
Copper	2.4 U	2.5 U	2.4 U	2.5 U	2.5 U	3.5 J
Iron	1,200	1,330	1,480	1,520	2,510	9,830
Lead	2.1	1.8	1.8	2.5	1.9	7.5
Magnesium	291 J	382 J	379 J	329 J	470 J	3,340
Manganese	14.7	16.4	20	19.4	31.4	71.1
Mercury	0.039 U	0.041 U	0.04 U	0.039 U	0.042 U	0.097 U
Nickel	2.4 U	2.5 U	2.4 U	2.5 U	0.88 J	6.3
Potassium	1,200 U	1,230 U	1,220 U	1,240 U	256 J	1,310 J
Selenium	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.9 J
Silver	2.4 U	2.5 U	2.4 U	2.5 U	2.5 U	5.3 U
Sodium	1,200 J	1,700	1,480	1,310	1,320	5,310
Thallium	2.4 U	2.5 U	2.4 U	2.5 U	2.5 U	5.3 U
Vanadium	2.7 J	2.9 J	3 J	3.5 J	4.4	27.5
Zinc	4 J	2.4 J	2.7 J	5.5	4.6 J	10.4 J
Wet Chemistry						
Total organic carbon (TOC) (mg/kg)	1,430 J	1,110 J	NA	1,780	4,360	NA
Grain Size (PCT/P)						
Clay (%)	0	0	1	0	2	3.5
Gravel (%)	0	0	0	0	0	6
Sand (%)	90	91	89.5	97	96	57.6
Silt (%)	10	9	9.5	3	2	32.9

Notes:

Shading indicates detections

NA - Not analyzed

J - Analyte present, value may or may not be accurate or precise

U - The material was analyzed for, but not detected

UJ - Analyte not detected, quantitation limit may be inaccurate

MG/KG - Milligrams per kilogram

PCT/P - Percent Passed

UG/KG - Micrograms per kilogram

TABLE D-3
Raw Surface Water Analytical Data
Former Skeet and Trap Range #1
MCAS Cherry Point, North Carolina

Station ID	STR01-SW01	STR01-SW02		STR01-SW03
Sample ID	STR01-SW01-0509	STR01-SW02-0509	STR01-SW02-P-0509	STR01-SW03-0509
Sample Date	05/20/09	05/20/09	05/20/09	05/20/09
Chemical Name				
Semivolatile Organic Compounds (UG/L)				
2-Methylnaphthalene	1.1 U	1 U	1.1 U	0.98 U
Acenaphthene	1.1 U	1 U	1.1 UJ	0.98 UJ
Acenaphthylene	1.1 U	0.074 J	1.1 UJ	0.98 UJ
Anthracene	1.1 U	1 U	1.1 U	0.98 U
Benzo(a)anthracene	0.56 U	0.55 U	0.6 U	0.52 U
Benzo(a)pyrene	0.8 U	0.73 U	0.79 U	0.049 UJ
Benzo(b)fluoranthene	0.71	0.67 J	0.7 J	0.049 UJ
Benzo(g,h,i)perylene	1.1 U	1 U	1.1 U	0.98 U
Benzo(k)fluoranthene	0.87	0.79 J	0.87 J	0.24 UJ
Chrysene	1.1 U	1 UJ	1.1 UJ	0.98 UJ
Dibenz(a,h)anthracene	0.61	0.55 J	0.056 UJ	0.049 UJ
Fluoranthene	1.1 U	1 U	1.1 U	0.98 U
Fluorene	1.1 U	1 U	1.1 U	0.98 U
Indeno(1,2,3-cd)pyrene	0.56	0.05 UJ	0.056 UJ	0.049 UJ
Naphthalene	0.56 U	0.5 U	0.56 U	0.49 U
Phenanthrene	1.1 U	1 U	1.1 U	0.98 U
Pyrene	1.1 U	1 U	1.1 U	0.98 U
Total Metals (UG/L)				
Aluminum	215 U	350	352	339
Antimony	15 U	15 U	15 U	15 U
Arsenic	10 U	10 U	10 U	10 U
Barium	39.1 J	38.4 J	39.3 J	41.8 J
Beryllium	5 U	5 U	5 U	5 U
Cadmium	1.7 J	1.7 J	1.6 J	1.3 J
Calcium	113,000 J	121,000 J	125,000 J	95,100 J
Chromium	10 U	10 U	10 U	10 U
Cobalt	15 U	15 U	15 U	15 U
Copper	10 U	10 U	10 U	10 U
Iron	210	311	316	417
Lead	3 U	3 U	3 U	3 U
Magnesium	330,000	352,000	363,000	279,000
Manganese	77.7	143	149	115
Mercury	0.2 U	0.2 U	0.2 U	0.2 U
Nickel	4.2 J	4.9 J	3.9 J	5.7 J
Potassium	97,000 J	112,000	113,000	95,600
Selenium	3.3 J	3.1 J	4.2 J	5 U
Silver	10 U	10 U	10 U	10 U
Sodium	2,690,000	2,880,000	2,940,000	2,200,000
Thallium	10 U	10 U	10 U	10 U
Vanadium	15 U	15 U	15 U	15 U
Zinc	20 U	20 U	20 U	20 U
Dissolved Metals (UG/L)				
Aluminum, Dissolved	200 U	200 U	200 U	200 U
Antimony, Dissolved	15 U	15 U	15 U	15 U
Arsenic, Dissolved	10 U	10 U	10 U	10 U
Barium, Dissolved	41.8	39.7 J	39.6 J	38.2 J
Beryllium, Dissolved	5 U	5 U	5 U	5 U
Cadmium, Dissolved	2.1 J	2.3 J	2.2 J	1.8 J
Calcium, Dissolved	129,000 J	134,000 J	135,000 J	101,000 J
Chromium, Dissolved	10 U	10 U	10 U	10 U
Cobalt, Dissolved	15 U	15 U	15 U	15 U
Copper, Dissolved	10 U	10 U	10 U	10 U
Iron, Dissolved	100 U	100 U	100 U	100 U
Lead, Dissolved	6 U	3 U	3 U	3 U
Magnesium, Dissolved	375,000	389,000	392,000	288,000
Manganese, Dissolved	15 U	3.5 J	5.1 J	15 U
Mercury, Dissolved	0.2 U	0.2 U	0.2 U	0.2 U
Nickel, Dissolved	10 U	10 U	10 U	10 U
Potassium, Dissolved	109,000	120,000	116,000	87,000
Selenium, Dissolved	3.1 J	3.5 J	5 U	5 U
Silver, Dissolved	10 U	10 U	10 U	10 U
Sodium, Dissolved	2,860,000	2,930,000	2,930,000	2,230,000
Thallium, Dissolved	10 U	10 U	10 U	10 U
Vanadium, Dissolved	15 U	15 U	15 U	15 U
Zinc, Dissolved	20 U	20 U	20 U	20 U
Wet Chemistry				
Hardness (mg/l)	1,640	1,750	1,800	1,380

Notes:

Shading indicates detections

NA - Not analyzed

J - Analyte present, value may or may not be accurate or precise

U - The material was analyzed for, but not detected

UJ - Analyte not detected, quantitation limit may be inaccurate

MG/L - Milligrams per liter

UG/L - Micrograms per liter

TABLE D-4
Raw Sediment Analytical Data - 2012
Former Skeet and Trap Range #1
MCAS Cherry Point, North Carolina

Sample ID				STR1-SD13-0-1-0212	STR1-SD13D-0-1-0212	STR1-SD14-0-1-0212	STR1-SD15-0-1-0212	STR1-SD16-0-1-0212	STR1-SD17-0-1-0212	STR1-SD18-0-1-0212	STR1-SD19-0-1-0212	STR1-SD20-0-1-0212	STR1-SD21-0-1-0212	STR1-SD22-0-1-0212	STR1-SD23-0-1-0212	STR1-SD23D-0-1-0212
Sample Date				2/7/12	2/7/12	2/7/12	2/7/12	2/7/12	2/7/12	2/7/12	2/7/12	2/7/12	2/7/12	2/7/12	2/7/12	2/7/12
Chemical Name	**Frequency**	**Max Value**	**Max Location**													
Semivolatile Organic Compounds (MG/KG)																
2-Methylnaphthalene	2 / 13	0.00875	STR1-SD20-0-1-0212	0.00395 U	0.00404 U	0.0042 U	0.00426 U	0.00422 U	0.00504 U	0.00253 J	0.0044 U	0.00875	0.00388 U	0.00405 U	0.00399 U	0.00403 U
Acenaphthene	2 / 13	0.0436	STR1-SD20-0-1-0212	0.00395 U	0.00404 U	0.0042 U	0.00426 U	0.00422 U	0.00504 U	0.00784 J	0.0044 U	0.0436	0.00388 U	0.00405 U	0.00399 U	0.00403 U
Anthracene	2 / 13	0.104	STR1-SD20-0-1-0212	0.00395 U	0.00404 U	0.0042 U	0.00426 U	0.00422 U	0.00504 U	0.0134	0.0044 U	0.104	0.00388 U	0.00405 U	0.00399 U	0.00403 U
Benzo(a)anthracene	2 / 13	0.923	STR1-SD20-0-1-0212	0.00395 U	0.00404 U	0.0042 U	0.00426 U	0.00422 U	0.00504 U	0.176	0.0044 U	0.923	0.00388 U	0.00405 U	0.00399 U	0.00403 U
Benzo(a)pyrene	5 / 13	0.776	STR1-SD20-0-1-0212	0.00278 J	0.0036 J	0.0042 U	0.00426 U	0.00422 U	0.00504 U	0.228	0.00313 J	0.776	0.00388 U	0.00405 U	0.00399 U	0.00403 U
Benzo(b)fluoranthene	3 / 13	0.715	STR1-SD20-0-1-0212	0.00395 U	0.00363 J	0.0042 U	0.00426 U	0.00422 U	0.00504 U	0.209	0.0044 U	0.715	0.00388 U	0.00405 U	0.00399 U	0.00403 U
Benzo(g,h,i)perylene	5 / 13	0.371	STR1-SD20-0-1-0212	0.00228 J	0.00232 J	0.0042 U	0.00426 U	0.00422 U	0.00504 U	0.155	0.00277 J	0.371	0.00388 U	0.00405 U	0.00399 U	0.00403 U
Benzo(k)fluoranthene	3 / 13	0.653	STR1-SD20-0-1-0212	0.00395 U	0.00368 J	0.0042 U	0.00426 U	0.00422 U	0.00504 U	0.197	0.0044 U	0.653	0.00388 U	0.00405 U	0.00399 U	0.00403 U
Chrysene	2 / 13	0.964	STR1-SD20-0-1-0212	0.00395 U	0.00404 U	0.0042 U	0.00426 U	0.00422 U	0.00504 U	0.218	0.0044 U	0.964	0.00388 U	0.00405 U	0.00399 U	0.00403 U
Dibenz(a,h)anthracene	2 / 13	0.133	STR1-SD20-0-1-0212	0.00395 U	0.00404 U	0.0042 U	0.00426 U	0.00422 U	0.00504 U	0.0492	0.0044 U	0.133	0.00388 U	0.00405 U	0.00399 U	0.00403 U
Fluoranthene	6 / 13	1.20	STR1-SD20-0-1-0212	0.00314 J	0.00737 J	0.0042 U	0.00426 U	0.00422 U	0.00504 U	0.198	0.0066 J	1.2	0.00493 J	0.00405 U	0.00399 U	0.00403 U
Fluorene	2 / 13	0.0219	STR1-SD20-0-1-0212	0.00395 U	0.00404 U	0.0042 U	0.00426 U	0.00422 U	0.00504 U	0.0044 J	0.0044 U	0.0219	0.00388 U	0.00405 U	0.00399 U	0.00403 U
Indeno(1,2,3-cd)pyrene	3 / 13	0.399	STR1-SD20-0-1-0212	0.00395 U	0.00404 U	0.0042 U	0.00426 U	0.00422 U	0.00504 U	0.147	0.00246 J	0.399	0.00388 U	0.00405 U	0.00399 U	0.00403 U
Naphthalene	1 / 13	0.0283	STR1-SD20-0-1-0212	0.00395 U	0.00404 U	0.0042 U	0.00426 U	0.00422 U	0.00504 U	0.00397 U	0.0044 U	0.0283	0.00388 U	0.00405 U	0.00399 U	0.00403 U
Phenanthrene	6 / 13	0.397	STR1-SD20-0-1-0212	0.00236 J	0.00263 J	0.0042 U	0.00426 U	0.00422 U	0.00504 U	0.054	0.00294 J	0.397	0.00341 J	0.00405 U	0.00399 U	0.00403 U
Pyrene	6 / 13	1.01	STR1-SD20-0-1-0212	0.00261 J	0.00622 J	0.0042 U	0.00426 U	0.00422 U	0.00504 U	0.189	0.00525 J	1.01	0.00427 J	0.00405 U	0.00399 U	0.00403 U
Wet Chemistry (MG/KG)																
Total Organic Carbon (TOC)	11 / 11	8,390	STR1-SD17-0-1-0212	754	NS	1,860	2,060	2,420	8,390	2,070	4,510	1,520	2,780	1,950	1,540	NS
Grain Size (PCT)																
Coarse Sand (%)	11 / 11	10.00	STR1-SD22-0-1-0212	0.00E+00	NS	6	1	2	2	4	0.00E+00	1	2	10	0.00E+00	NS
Fine Sand (%)	11 / 11	78.0	STR1-SD13-0-1-0212	78	NS	44	61	22	22	63	6	62	63	60	62	NS
Fines (%)	11 / 11	94.0	STR1-SD19-0-1-0212	22	NS	41	30	10	10	21	94	19	26	20	7	NS
Gravel (%)	11 / 11	1.000	STR1-SD16-0-1-0212	0.00E+00	NS	0.00E+00	0.00E+00	1	1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1	0.00E+00	NS
GS03 Sieve 3" (75 mm)	11 / 11	100.0	STR1-SD13-0-1-0212	100	NS	100	100	100	100	100	100	100	100	100	100	NS
GS05 Sieve 2" (50 mm)	11 / 11	100.0	STR1-SD13-0-1-0212	100	NS	100	100	100	100	100	100	100	100	100	100	NS
GS06 Sieve 1.5" (37.5 mm)	11 / 11	100.0	STR1-SD13-0-1-0212	100	NS	100	100	100	100	100	100	100	100	100	100	NS
GS07 Sieve 1" (25.0 mm)	11 / 11	100.0	STR1-SD13-0-1-0212	100	NS	100	100	100	100	100	100	100	100	100	100	NS
GS08 Sieve 0.75" (19.0 mm)	11 / 11	100.0	STR1-SD13-0-1-0212	100	NS	100	100	100	100	100	100	100	100	100	100	NS
GS10 Sieve 0.375" (9.5 mm)	11 / 11	100.0	STR1-SD13-0-1-0212	100	NS	100	100	100	100	100	100	100	100	100	100	NS
Medium Sand (%)	11 / 11	65.0	STR1-SD16-0-1-0212	0.00E+00	NS	9	8	65	65	12	0.00E+00	18	9	9	31	NS
Sieve No. 004 (4.75 mm)	11 / 11	100.0	STR1-SD13-0-1-0212	100	NS	100	100	99	99	100	100	100	100	99	100	NS
Sieve No. 010 (2.00 mm)	11 / 11	100.0	STR1-SD13-0-1-0212	100	NS	99	99	99	99	99	100	100	99	95	100	NS
Sieve No. 020 (850 um)	11 / 11	100.0	STR1-SD13-0-1-0212	100	NS	94	98	97	97	96	100	99	98	89	100	NS
Sieve No. 040 (425 um)	11 / 11	100.0	STR1-SD13-0-1-0212	100	NS	85	90	32	32	84	99	81	89	80	69	NS
Sieve No. 060 (250 um)	11 / 11	99.0	STR1-SD19-0-1-0212	70	NS	79	78	18	18	70	99	48	56	57	22	NS
Sieve No. 080 (180 um)	11 / 11	97.0	STR1-SD19-0-1-0212	31	NS	48	32	12	12	22	97	27	31	57	10	NS
Sieve No. 100 (150 um)	11 / 11	94.0	STR1-SD19-0-1-0212	22	NS	41	30	10	10	21	94	19	27	20	7	NS
Sieve No. 200 (75 um)	11 / 11	12.0	STR1-SD19-0-1-0212	3	NS	3	6	4	4	2	12	0.00E+00	7	7	2	NS

\\tlarheel\Proj\EBL\Navy Clean\MRP\Cherry Point MR Program\Reports\Site Inspection\Skeet and Trap Range #1\Expanded Site Inspection\Draft_In Progress\Appendices\Appendix D- Raw Data Tables\[Skeet Range Raw Analytical Data_2012.xlsx], jacaron, 05/04/2012

Notes:

J - Analyte present. Value may or may not be accurate or precise

MG/KG - Milligrams per kilogram

NS - Not sampled

PCT - Percent

PCT/P - Percent Passed

U - The material was analyzed for, but not detected

Shading indicates detection

Appendix E
Human Health Risk Screening Tables

TABLE E.1

Occurrence, Distribution and Selection of Chemicals of Potential Concern

Former Skeet Range ESI

MCAS Cherry Point, North Carolina

Scenario Timeframe: Current/Future
Medium: Sediment
Exposure Medium: Sediment

Exposure Point	CAS Number	Chemical	Minimum [1] Concentration Qualifier	Maximum [1] Concentration Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration [2] Used for Screening	Background [3] Value	Screening [4] Toxicity Value	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for [5] Contaminant Deletion or Selection
Sediment	91-57-6	2-Methylnaphthalene	2.5E-03 J	8.8E-03	MG/KG	STR1-SD20-0-1-0212	3/15	0.0039-0.11	8.8E-03	2.8E-03 - 2.8E-03	2.3E+01 N	N/A	N/A	NO	BSL
	83-32-9	Acenaphthene	2.0E-03 J	4.4E-02	MG/KG	STR1-SD20-0-1-0212	5/15	0.0039-0.11	4.4E-02	N/A	3.4E+02 N	N/A	N/A	NO	BSL
	208-96-8	Acenaphthylene	ND	ND	MG/KG		0/15	0.0039-0.11	1.1E-01	N/A	3.4E+02 N	N/A	N/A	NO	DLBSL
	120-12-7	Anthracene	6.5E-03 J	1.0E-01	MG/KG	STR1-SD20-0-1-0212	8/15	0.0039-0.11	1.0E-01	6.6E-03 - 6.6E-03	1.7E+03 N	N/A	N/A	NO	BSL
	56-55-3	**Benzo(a)anthracene**	**5.6E-02 J**	**9.2E-01**	**MG/KG**	**STR1-SD20-0-1-0212**	**5/15**	**0.0039-0.11**	**9.2E-01**	N/A	**1.5E-01 C**	**N/A**	**N/A**	**YES**	**ASL**
	50-32-8	**Benzo(a)pyrene**	**6.8E-03 J**	**1.4E+00**	**MG/KG**	**STR01-SD01-0-1-0509**	**10/15**	**0.0039-0.11**	**1.4E+00**	**3.1E-03 - 3.6E-03**	**1.5E-02 C**	**N/A**	**N/A**	**YES**	**ASL**
	205-99-2	**Benzo(b)fluoranthene**	**6.3E-03 J**	**1.9E+00**	**MG/KG**	**STR01-SD01-0-1-0509**	**11/15**	**0.0039-0.11**	**1.9E+00**	**3.6E-03 - 7.1E-03**	**1.5E-01 C**	**N/A**	**N/A**	**YES**	**ASL**
	191-24-2	Benzo(g,h,i)perylene	3.1E-03 J	8.0E-01	MG/KG	STR01-SD01-0-1-0509	10/15	0.0039-0.11	8.0E-01	2.3E-03 - 3.2E-03	1.7E+02 N	N/A	N/A	NO	BSL
	207-08-9	**Benzo(k)fluoranthene**	**7.3E-03 J**	**6.5E-01**	**MG/KG**	**STR1-SD20-0-1-0212**	**12/15**	**0.0039-0.11**	**6.5E-01**	**3.7E-03 - 3.7E-03**	**1.5E+00 C**	**N/A**	**N/A**	**YES**	**CPAH**
	218-01-9	**Chrysene**	**2.0E-03 J**	**9.6E-01**	**MG/KG**	**STR1-SD20-0-1-0212**	**8/15**	**0.0039-0.11**	**9.6E-01**	N/A	**1.5E+01 C**	**N/A**	**N/A**	**YES**	**CPAH**
	53-70-3	**Dibenz(a,h)anthracene**	**8.7E-03 J**	**1.3E-01**	**MG/KG**	**STR1-SD20-0-1-0212**	**4/15**	**0.0039-0.11**	**1.3E-01**	N/A	**1.5E-02 C**	**N/A**	**N/A**	**YES**	**ASL**
	206-44-0	Fluoranthene	3.5E-03 J	1.2E+00	MG/KG	STR1-SD20-0-1-0212	4/15	0.0039-0.11	1.2E+00	6.6E-03 - 7.4E-03	2.3E+02 N	N/A	N/A	NO	BSL
	86-73-7	Fluorene	4.4E-03 J	2.2E-02	MG/KG	STR1-SD20-0-1-0212	10/15	0.0039-0.11	2.2E-02	6.1E-03 - 6.8E-03	2.3E+02 N	N/A	N/A	NO	BSL
	193-39-5	**Indeno(1,2,3-cd)pyrene**	**1.1E-01 J**	**7.9E-01**	**MG/KG**	**STR01-SD01-0-1-0509**	**5/15**	**0.0039-0.11**	**7.9E-01**	**2.5E-03 - 2.5E-03**	**1.5E-01 C**	**N/A**	**N/A**	**YES**	**ASL**
	91-20-3	Naphthalene	4.0E-03 J	2.8E-02	MG/KG	STR1-SD20-0-1-0212	3/15	0.0039-0.11	2.8E-02	3.6E-03 - 3.6E-03	3.6E+00 C	N/A	N/A	NO	BSL
	85-01-8	Phenanthrene	2.8E-03	4.0E-01	MG/KG	STR1-SD20-0-1-0212	8/15	0.0039-0.11	4.0E-01	2.6E-03 - 2.9E-03	1.7E+03 N	N/A	N/A	NO	BSL
	129-00-0	Pyrene	1.7E-03 J	1.0E+00	MG/KG	STR1-SD20-0-1-0212	12/15	0.0039-0.11	1.0E+00	5.3E-03 - 6.2E-03	1.7E+02 N	N/A	N/A	NO	BSL

[1] Minimum/Maximum detected concentrations.

[2] Maximum concentration is used for screening.

[3] Background values are the range of detected concentrations from samples STR01-SD11-0-1-0509, STR01-SD12-0-1-0509, STR1-SD13-0-1-021, STR1-SD14-0-1-0212 through STR1-SD17-0-1-0212, and STR1-SD19-0-1-0212.

[4] Oak Ridge National Laboratory (ORNL). May, 2012. Residential Soil Regional Screening Levels for Chemical Contaminants at Superfund Sites(based on 10-6 for carcinogens and HQ of 0.1 for noncarcinogens). Available: http://epa-prgs.ornl.gov/chemicals/index.shtml
RSL value for acenaphthene used as surrogate for acenaphthylene.
RSL value for pyrene used as surrogate for benzo(g,h,i)perylene.
RSL value for anthracene used as surrogate for phenanthrene.

[5] Rationale Codes

Selection Reason: Above Screening Levels (ASL)
Detection Limit Above Screening Levels (DLASL)
Chemical from same class (carcinogenic PAH) identified as a COPC (CPAH)

Deletion Reason: No Toxicity Information (NTX)
Essential Nutrient (NUT)
Below Screening Level (BSL)
Detection Limit Below Screening Level (DLBSL)

COPC = Chemical of Potential Concern
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered
J = Estimated Value
D - Compound identified in an analysis at a secondary dilution factor.
C = Carcinogenic
N = Noncarcinogenic
N/A = Not available
ND = Not Detected
mg/kg = milligram per kilogram

TABLE E.2

Step 2 Sediment Screening - Risk Ratio, Maximum Detected Concentration

Former Skeet Range ESI

MCAS Cherry Point, North Carolina

Analyte	Detection Frequency	Maximum Detected Concentration (Qualifier)	Sample Location of Maximum Detected Concentration	Residential Soil RSL	Acceptable Risk Level	Corresponding Hazard Index[a]	Corresponding Cancer Risk[b]	Target Organ
Semivolatile Organic Compounds (mg/kg)								
Benzo(a)anthracene	5 / 15	9.2E-01	STR1-SD20-0-1-0212	1.5E-01	1.0E-06	NA	6.2E-06	NA
Benzo(a)pyrene	10 / 15	1.4E+00	STR01-SD01-0-1-0509	1.5E-02	1.0E-06	NA	9.3E-05	NA
Benzo(b)fluoranthene	11 / 15	1.9E+00	STR01-SD01-0-1-0509	1.5E-01	1.0E-06	NA	1.3E-05	NA
Benzo(k)fluoranthene	12 / 15	6.5E-01	STR1-SD20-0-1-0212	1.5E+00	1.0E-06	NA	4.4E-07	NA
Chrysene	8 / 15	9.6E-01	STR1-SD20-0-1-0212	1.5E+01	1.0E-06	NA	6.4E-08	NA
Dibenz(a,h)anthracene	4 / 15	1.3E-01	STR1-SD20-0-1-0212	1.5E-02	1.0E-06	NA	8.9E-06	NA
Indeno(1,2,3-cd)pyrene	5 / 15	7.9E-01	STR01-SD01-0-1-0509	1.5E-01	1.0E-06	NA	5.3E-06	NA
Cumulative Corresponding Hazard Index[c]						NA		
Cumulative Corresponding Cancer Risk[d]							1.E-04	

Notes:

[a] Corresponding Hazard Index equals maximum detected concentration divided by the RSL divided by the acceptable risk level.

[b] Corresponding Cancer Risk equals maximum detected concentration divided by the RSL divided by the acceptable risk level.

[c] Cumulative Corresponding Hazard Index equals sum of Corresponding Hazard Indices for each constituent.

[d] Cumulative Corresponding Cancer Risk equals sum of Corresponding Cancer Risks for each constituent.

Constituent selected as COPC if it contributes to an overall Hazard Index by target organ greater than 0.5 or Cumulative Corresponding Cancer Risk greater than 5E-05, otherwise, constituent not selected as COPC.

Constituents selected as COPCs are indicated by shading.

COPC = Constituent of Potential Concern

mg/kg = milligrams per kilogram

NA = Not available/not applicable

TABLE E.3

Step 3 Sediment Screening - Risk Ratio, 95% UCL Concentration

Former Skeet Range ESI

MCAS Cherry Point, North Carolina

Analyte	Detection Frequency	95% UCL		95% UCL Rationale	EPA Regional Screening Level	Acceptable Risk Level	Corresponding Hazard Index[a]	Corresponding Cancer Risk[b]	Target Organ
Semivolatile Organic Compounds (mg/kg)									
Benzo(a)anthracene	5 / 15	3.0E-01	95% KM-t	1, 2, 3	1.5E-01	1.0E-06	NA	2.0E-06	
Benzo(a)pyrene	10 / 15	3.9E-01	95% KM-BCA	1, 3	1.5E-02	1.0E-06	NA	2.6E-05	
Benzo(b)fluoranthene	11 / 15	8.1E-01	95% KM	1, 3	1.5E-01	1.0E-06	NA	5.4E-06	
Benzo(k)fluoranthene	12 / 15	6.4E-01	99% KM	4	1.5E+00	1.0E-06	NA	4.3E-07	
Chrysene	8 / 15	2.9E-01	95% KM-BCA	1, 3	1.5E+01	1.0E-06	NA	2.0E-08	
Dibenz(a,h)anthracene	4 / 15	3.8E-02	95% KM-t	1, 2, 3	1.5E-02	1.0E-06	NA	2.6E-06	
Indeno(1,2,3-cd)pyrene	5 / 15	2.8E-01	95% KM-t	1, 2, 3	1.5E-01	1.0E-06	NA	1.8E-06	
Cumulative Corresponding Hazard Index[c]							**NA**		
Cumulative Corresponding Cancer Risk[d]								**4.E-05**	

[a] Corresponding Hazard Index equals 95% UCL divided by the RSL divided by the acceptable risk level.

[b] Corresponding Cancer Risk equals maximum detected concentration divided by the RSL divided by the acceptable risk level.

[c] Cumulative Corresponding Hazard Index equals sum of Corresponding Hazard Indices for each constituent.

[d] Cumulative Corresponding Cancer Risk equals sum of Corresponding Cancer Risks for each constituent.

Constituent selected as COPC if it contributes to an overall Hazard Index by target organ greater than 0.5 or Cumulative Corresponding Cancer Risk greater than 5E-05,
Constituents selected as COPCs are indicated by shading.
ug/L = micrograms per liter
HI = Hazard Index
NA = Not available/not applicable

ProUCL, Version 4.1.00 used to determine distribution of data and calculate 95% UCL, following recommendations
in users guide (USEPA. May 2010. Prepared by Lockheed Martin Environmental Services).
Options: 95% Kaplan-Meier t UCL (95% KM-t); 95% Kaplan-Meier BCA UCL (95% KM-BCA); 95% Kaplan-Meier Chebyshev (95% KM); 99% Kaplan-Meier Chebyshev (99% KM)

UCL Rationale:
(1) Shapiro-Wilk W Test/Lilliefors test indicates data are log-normally distributed.
(2) Shapiro-Wilk W Test/Lilliefors indicates data are normally distributed.
(3) Test indicates data are gamma distributed.
(4) Distribution tests are inconclusive.

Appendix F
Ecological Risk Screening Tables

TABLE F-1

Surface Sediment Samples

Former Skeet Range ESI

MCAS Cherry Point, North Carolina

Area/Sample Type	Station ID	Sample ID	Sample Date
Site Sample Locations	STR01-SD01	STR01-SD01-0-1-0509	05/21/09
	STR01-SD02	STR01-SD02-0-1-0509	05/21/09
	STR01-SD03	STR01-SD03-0-1-0509	05/21/09
		STR01-SD03-P-0-1-0509	Duplicate
	STR01-SD04	STR01-SD04-0-1-0509	05/21/09
	STR01-SD05	STR01-SD05-0-1-0509	05/21/09
	STR01-SD06	STR01-SD06-0-1-0509	05/21/09
	STR01-SD07	STR01-SD07-0-1-0509	05/21/09
	STR01-SD08	STR01-SD08-0-1-0509	05/21/09
	STR01-SD09	STR01-SD09-0-1-0509	05/21/09
		STR01-SD09-P-0-1-0509	Duplicate
	STR01-SD10	STR01-SD10-0-1-0509	05/21/09
	STR1-SD18	STR1-SD18-0-1-0212	02/07/12
	STR1-SD20	STR1-SD20-0-1-0212	02/07/12
	STR1-SD21	STR1-SD21-0-1-0212	02/07/12
	STR1-SD22	STR1-SD22-0-1-0212	02/07/12
	STR1-SD23	STR1-SD23-0-1-0212	02/07/12
		STR1-SD23D-0-1-0212	Duplicate
Background Sample Locations	STR01-SD11	STR01-SD11-0-1-0509	05/21/09
	STR01-SD12	STR01-SD12-0-1-0509	05/21/09
	STR1-SD13	STR1-SD13-0-1-0212	02/07/12
		STR1-SD13D-0-1-0212	Duplicate
	STR1-SD14	STR1-SD14-0-1-0212	02/07/12
	STR1-SD15	STR1-SD15-0-1-0212	02/07/12
	STR1-SD16	STR1-SD16-0-1-0212	02/07/12
	STR1-SD17	STR1-SD17-0-1-0212	02/07/12
	STR1-SD19	STR1-SD19-0-1-0212	02/07/12

TABLE F-2

Summary Statistics and Raw Data - Background Surface Sediment

Former Skeet Range ESI

MCAS Cherry Point, North Carolina

Constituent	Summary Statistics (MG/KG)					Sample-Specific Results (MG/KG)								
	Maximum Detection	Location of Maximum	Average Concentration [1]	Frequency of Detection	Reporting Limit Range for Non-Detects	STR01-SD11	STR01-SD12	STR1-SD13		STR1-SD14	STR1-SD15	STR1-SD16	STR1-SD17	STR1-SD19
						STR01-SD11-0-1-0509	STR01-SD12-0-1-0509	STR1-SD13-0-1-0212	STR1-SD13D-0-1-0212	STR1-SD14-0-1-0212	STR1-SD15-0-1-0212	STR1-SD16-0-1-0212	STR1-SD17-0-1-0212	STR1-SD19-0-1-0212
						05/21/09	05/21/09	02/07/12	Duplicate	02/07/12	02/07/12	02/07/12	02/07/12	02/07/12
2-Methylnaphthalene	0.0028 J	STR01-SD12	0.0066	1 / 8	0.00395 - 0.083	0.083 U	0.0028 J	0.00395 U	0.00404 U	0.0042 U	0.00426 U	0.00422 U	0.00504 U	0.0044 U
Acenaphthene	--	--	0.0111	0 / 8	0.00395 - 0.083	0.083 U	0.086 U	0.00395 U	0.00404 U	0.0042 U	0.00426 U	0.00422 U	0.00504 U	0.0044 U
Acenaphthylene	--	--	0.0111	0 / 8	0.00395 - 0.083	0.083 U	0.086 U	0.00395 U	0.00404 U	0.0042 U	0.00426 U	0.00422 U	0.00504 U	0.0044 U
Anthracene	0.0066 J	STR01-SD11	0.0072	1 / 8	0.00395 - 0.00504	0.0066 J	0.086 U	0.00395 U	0.00404 U	0.0042 U	0.00426 U	0.00422 U	0.00504 U	0.0044 U
Benzo(a)anthracene	--	--	0.0111	0 / 8	0.00395 - 0.083	0.083 U	0.086 U	0.00395 U	0.00404 U	0.0042 U	0.00426 U	0.00422 U	0.00504 U	0.0044 U
Benzo(a)pyrene	0.0036 J	STR01-SD11	0.0030	2 / 8	0.0042 - 0.0083	0.0083 U	0.0086 U	0.00278 J	0.0036 J	0.0042 U	0.00426 U	0.00422 U	0.00504 U	0.00313 J
Benzo(b)fluoranthene	0.0071 J	STR01-SD12	0.0073	2 / 8	0.00395 - 0.083	0.083 U	0.0071 J	0.00395 U	0.00363 J	0.0042 U	0.00426 U	0.00422 U	0.00504 U	0.0044 U
Benzo(g,h,i)perylene	0.0032 J	STR01-SD11	0.0069	3 / 8	0.0042 - 0.081	0.0032 J	0.086 U	0.00228 J	0.00232 J	0.0042 U	0.00426 U	0.00422 U	0.00504 U	0.00277 J
Benzo(k)fluoranthene	0.00368 J	STR01-SD13	0.0112	1 / 8	0.00395 - 0.083	0.083 U	0.086 U	0.00395 U	0.00368 J	0.0042 U	0.00426 U	0.00422 U	0.00504 U	0.0044 U
Chrysene	--	--	0.0111	0 / 8	0.00395 - 0.083	0.083 U	0.086 U	0.00395 U	0.00404 U	0.0042 U	0.00426 U	0.00422 U	0.00504 U	0.0044 U
Dibenz(a,h)anthracene	--	--	0.0026	0 / 8	0.00395 - 0.0083	0.0083 U	0.0086 U	0.00395 U	0.00404 U	0.0042 U	0.00426 U	0.00422 U	0.00504 U	0.0044 U
Fluoranthene	0.00737 J	STR01-SD13	0.0123	2 / 8	0.0042 - 0.083	0.083 U	0.086 U	0.00314 J	0.00737 J	0.0042 U	0.00426 U	0.00422 U	0.00504 U	0.0066 J
Fluorene	0.0068 J	STR01-SD12	0.0031	2 / 8	0.00395 - 0.00504	0.0061 J	0.0068 J	0.00395 U	0.00404 U	0.0042 U	0.00426 U	0.00422 U	0.00504 U	0.0044 U
Indeno(1,2,3-cd)pyrene	0.00246 J	STR01-SD19	0.0111	1 / 8	0.00395 - 0.083	0.083 U	0.086 U	0.00395 U	0.00404 U	0.0042 U	0.00426 U	0.00422 U	0.00504 U	0.00246 J
Naphthalene	0.0036 J	STR01-SD12	0.0067	1 / 8	0.00395 - 0.083	0.083 U	0.0036 J	0.00395 U	0.00404 U	0.0042 U	0.00426 U	0.00422 U	0.00504 U	0.0044 U
Phenanthrene	0.00294 J	STR01-SD19	0.0113	2 / 8	0.0042 - 0.083	0.083 U	0.086 U	0.00236 J	0.00263 J	0.0042 U	0.00426 U	0.00422 U	0.00504 U	0.00294 J
Pyrene	0.00622 J	STR01-SD13	0.0119	2 / 8	0.0042 - 0.083	0.083 U	0.086 U	0.00261 J	0.00622 J	0.0042 U	0.00426 U	0.00422 U	0.00504 U	0.00525 J
PAHs, Total [2]	0.02945	STR01-SD13	0.0204	4 / 8	-- - --	0.0159	0.0203	0.01317	0.02945	ND	ND	ND	ND	0.02315

Notes:

Shading indicates detections

ND - not detected

J - Analyte present, value may or may not be accurate or precise

U - The material was analyzed for, but not detected

MG/KG - Milligram per kilogram

1 - average of detections and 1/2 non-detect values, except for Total PAHs which are the average of detects only

2 - sum of all detected individual PAH compounds by sample

TABLE F-3

Summary Statistics and Raw Data - Site-Specific Surface Sediment

Former Skeet Range ESI

MCAS Cherry Point, North Carolina

Constituent	Summary Statistics (MG/KG)					Sample-Specific Results (MG/KG)						
	Maximum Concentration (mg/kg)	Location of Maximum Concentration	Average Concentration [1]	Frequency of Detection	Reporting Limit Range for Non-Detects	STR01-SD01 STR01-SD01-0-1-0509 05/21/09	STR01-SD02 STR01-SD02-0-1-0509 05/21/09	STR01-SD03 STR01-SD03-0-1-0509 05/21/09	STR01-SD03 STR01-SD03-P-0-1-0509 Duplicate	STR01-SD04 STR01-SD04-0-1-0509 05/21/09	STR01-SD05 STR01-SD05-0-1-0509 05/21/09	STR01-SD06 STR01-SD06-0-1-0509 05/21/09
2-Methylnaphthalene	0.00875	STR1-SD20	0.0266	3 / 15	0.00388 - 0.11	0.0048 J	0.086 U	0.083 U	0.092 U	0.074 U	0.073 U	0.079 U
Acenaphthene	0.0436	STR1-SD20	0.0255	5 / 15	0.00388 - 0.11	0.013 J	0.086 U	0.083 U	0.015 J	0.002 J	0.073 U	0.079 U
Acenaphthylene	--	--	0.0286	0 / 15	0.00388 - 0.11	0.083 U	0.086 U	0.083 U	0.092 U	0.074 U	0.073 U	0.079 U
Anthracene	0.104	STR1-SD20	0.0230	8 / 15	0.00388 - 0.11	0.017 J	0.086 U	0.083 U	0.092 U	0.0089 J	0.073 U	0.0076 J
Benzo(a)anthracene	0.923 D	STR1-SD20	0.1577	5 / 15	0.00388 - 0.11	0.59	0.086 U	0.083 U	0.32	0.056 J	0.073 U	0.079 U
Benzo(a)pyrene	1.4	STR01-SD01	0.1979	11 / 15	0.00388 - 0.0081	1.4	0.013	0.0078 J	0.37 J	0.12	0.0068 J	0.013
Benzo(b)fluoranthene	1.9	STR01-SD01	0.2378	12 / 15	0.00388 - 0.076	1.9	0.015 J	0.0072 J	0.47 J	0.16	0.0063 J	0.013 J
Benzo(g,h,i)perylene	0.8	STR01-SD01	0.1201	11 / 15	0.00388 - 0.081	0.8	0.0074 J	0.0034 J	0.24 J	0.12	0.0031 J	0.0073 J
Benzo(k)fluoranthene	0.653	STR1-SD20	0.1012	13 / 15	0.00388 - 0.092	0.550	0.01 J	0.0084 J	0.092 U	0.038 J	0.0073 J	0.01 J
Chrysene	0.964	STR1-SD20	0.1612	8 / 15	0.00388 - 0.11	0.67	0.002 J	0.083 U	0.34	0.055 J	0.073 U	0.0033 J
Dibenz(a,h)anthracene	0.133	STR1-SD20	0.0176	4 / 15	0.00388 - 0.011	0.0083 U	0.0086 U	0.0083 U	0.036	0.0074 U	0.0073 U	0.0079 U
Fluoranthene	1.2	STR1-SD20	0.1597	9 / 15	0.00399 - 0.11	0.30	0.017 J	0.083 U	0.42	0.074	0.073 U	0.079 U
Fluorene	0.0219	STR1-SD20	0.0126	10 / 15	0.00388 - 0.11	0.014 J	0.0065 J	0.083 U	0.012 J	0.0062 J	0.0054 J	0.0066 J
Indeno(1,2,3-cd)pyrene	0.79	STR01-SD01	0.1294	5 / 15	0.00388 - 0.11	0.79	0.086 U	0.083 U	0.23	0.11	0.073 U	0.079 U
Naphthalene	0.0283	STR1-SD20	0.0262	3 / 15	0.00388 - 0.11	0.018 J	0.086 U	0.083 U	0.0066 J	0.074 U	0.073 U	0.079 U
Phenanthrene	0.397	STR1-SD20	0.0532	10 / 15	0.00399 - 0.084	0.039 J	0.005 J	0.083 U	0.11	0.019 J	0.073 U	0.0028 J
Pyrene	1.01	STR1-SD20	0.1405	13 / 15	0.00399 - 0.081	0.37	0.012 J	0.0021 J	0.38 J	0.072 J	0.0017 J	0.0073 J
PAHs, Total [2]	7.7	STR1-SD20	1.63	13 / 15	-- - --	7.5	0.09	0.0289	2.95	0.84	0.0306	0.0709

Notes:

Shading indicates detections

ND - not detected

NA - Not analyzed

J - Analyte present, value may or may not be accurate or precise

U - The material was analyzed for, but not detected

UJ - Analyte not detected, quantitation limit may be inaccurate

MG/KG - Milligram per kilogram

1 - average of detections and 1/2 non-detect values, except for Total PAHs which are the average of detects only

2 - sum of all detected individual PAH

TABLE F-3

Summary Statistics and Raw Data - Site-Specifi

Former Skeet Range ESI

MCAS Cherry Point, North Carolina

	Sample-Specific Results (MG/KG) [3]										
	STR01-SD07	STR01-SD08	STR01-SD09		STR01-SD10	STR1-SD18	STR1-SD20	STR1-SD21	STR1-SD22	STR1-SD23	
	STR01-SD07-0-1-0509	STR01-SD08-0-1-0509	STR01-SD09-0-1-0509	STR01-SD09-P-0-1-0509	STR01-SD10-0-1-0509	STR1-SD18-0-1-0212	STR1-SD20-0-1-0212	STR1-SD21-0-1-0212	STR1-SD22-0-1-0212	STR1-SD23-0-1-0212	STR1-SD23D-0-1-0212
Constituent	05/21/09	05/21/09	05/21/09	Duplicate	05/21/09	02/07/12	02/07/12	02/07/12	02/07/12	02/07/12	Duplicate
2-Methylnaphthalene	0.076 U	0.084 U	0 U	0 U	0.081 U	0.00253 J	0.00875	0.00388 U	0.00405 U	0.00399 U	0.00403 U
Acenaphthene	0.076 U	0.084 U	0 U	0 U	0.081 U	0.00784 J	0.0436	0.00388 U	0.00405 U	0.00399 U	0.00403 U
Acenaphthylene	0.076 U	0.084 U	0 U	0 U	0.081 U	0.00397 U	0.00405 U	0.00388 U	0.00405 U	0.00399 U	0.00403 U
Anthracene	0.076 U	0.0069 J	0 U	0.011 J	0.0065 J	0.0134	0.104	0.00388 U	0.00405 U	0.00399 U	0.00403 U
Benzo(a)anthracene	0.076 U	0.084 U	0 U	0 U	0.081 U	0.176	0.923	0.00388 U	0.00405 U	0.00399 U	0.00403 U
Benzo(a)pyrene	0.0076 U	0.0083 J	0.019	0.016	0.0081 U	0.228	0.776	0.00388 U	0.00405 U	0.00399 U	0.00403 U
Benzo(b)fluoranthene	0.076 U	0.0079 J	0.02 J	0.016 J	0.0067 J	0.209	0.715	0.00388 U	0.00405 U	0.00399 U	0.00403 U
Benzo(g,h,i)perylene	0.076 U	0.004 J	0.013 J	0.0086 J	0.081 U	0.155	0.371	0.00388 U	0.00405 U	0.00399 U	0.00403 U
Benzo(k)fluoranthene	0.0076 J	0.0086 J	0.014 J	0.014 J	0.008 J	0.197	0.653	0.00388 U	0.00405 U	0.00399 U	0.00403 U
Chrysene	0.076 U	0.084 U	0.0021 J	0 U	0.081 U	0.218	0.964	0.00388 U	0.00405 U	0.00399 U	0.00403 U
Dibenz(a,h)anthracene	0.0076 U	0.0084 U	0.0087 J	0.011 U	0.0081 U	0.0492	0.133	0.00388 U	0.00405 U	0.00399 U	0.00403 U
Fluoranthene	0.0035 J	0.084 U	0 U	0.016 J	0.081 U	0.198	1.2	0.00493 J	0.00405 U	0.00399 U	0.00403 U
Fluorene	0.076 U	0.0063 J	0 U	0 U	0.006 J	0.0044 J	0.0219	0.00388 U	0.00405 U	0.00399 U	0.00403 U
Indeno(1,2,3-cd)pyrene	0.0048 U	0.084 U	0 U	0 U	0.081 U	0.147	0.399	0.00388 U	0.00405 U	0.00399 U	0.00403 U
Naphthalene	0.076 U	0.084 U	0 U	0 U	0.081 U	0.00397 U	0.0283	0.00388 U	0.00405 U	0.00399 U	0.00403 U
Phenanthrene	0.076 U	0.084 U	0.0034 J	0.0069 J	0.081 U	0.054	0.397	0.00341 J	0.00405 U	0.00399 U	0.00403 U
Pyrene	0.0018 J	0.0028 J	0.011 J	0.012 J	0.081 U	0.189	1.01	0.00427 J	0.00405 U	0.00399 U	0.00403 U
PAHs, Total [2]	0.0129	0.0448	0.091	0.101	0.027	1.85	7.75	0.013	ND	ND	ND

Notes:

Shading indicates detections

ND - not detected

NA - Not analyzed

J - Analyte present, value may or may not be accurate or precise

U - The material was analyzed for, but not detected

UJ - Analyte not detected, quantitation limit may be inaccurate

MG/KG - Milligram per kilogram

1 - average of detections and 1/2 non-detect values, except for Total PAHs which are the average of detects only

2 - sum of all detected individual PAH

TABLE F-4

Screening Results - Surface Sediment

Former Skeet Range ESI

MCAS Cherry Point, North Carolina

Chemical	Maximum Concentration (mg/kg)	Location of Maximum Concentration	Average Concentration (mg/kg)	Frequency of Detection	Comparion to Threshold Effect Concentration (TEC)[1]				Comparion to Probable Effect Concentration (PEC)[1]				Retain?	Reason
					TEC (mg/kg)	Frequency of TEC	Maximum HQ [2]	Average HQ	PEC (mg/kg)	Frequency of PEC	Maximum HQ	Average HQ		
PAHs, total	7.7	STR1-SD20	1.63	13 / 15	1.61	4 / 15	4.8	1.0	22.8	0 / 15	0.34	0.07	No	Low frequency of exceeding TEC; Average does not exceed TEC; No PEC exceedances

Notes

TEC - threshold effect level
PEC - probable effect level
HQ - hazard quotient

mg/kg - milligram per kilogram
1 - MacDonald et al. (2000)

2 - "HQs" are hazard quotients